WIRELESS FOR THE MAN-IN-THE-MOON

Perhaps a Fairy Tale, Perhaps a Textbook Perhaps Neither

BY

COULOMBUS & DECIBEL

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THE GREAT MOMENT HAS ARRIVED.

Frontispiece] [*See page 95.*

AUTHORS' PREFACE

MANY books on Wireless have been written for that ever-popular individual, the Man-in-the-Street, but nobody seems to have given a thought to the Man-in-the-Moon. In order to rectify this serious omission we have written the present book.

Although intended primarily for the Man-in-the-Moon, no doubt it will be read by various individuals anxious to find out whether it is a text-book, a novel, or perhaps a fairy story.

If you would like to know the correct answer, we suggest you do likewise.

THE AUTHORS.

PUBLISHERS' NOTE

THE Authors of *Wireless for the Man-in-the-Moon* have presented the principles of Wireless in an entirely novel manner.

The wit and humour of the book will appeal to readers who know nothing whatever about Wireless, as well as to the expert. The former (and perhaps the latter) will find on reading it that they have unconsciously acquired a real insight into the basic principles and practice of Wireless. In short, in the words of Jack Point, "Oh, winnow all my folly, folly, folly, and you'll find a grain or two of truth among the chaff!"

WIRELESS FOR THE MAN-IN-THE-MOON

CHAPTER I

How it All Came About

Before it is possible to understand Wireless it is necessary to understand Electricity. As nobody understands Electricity, it is not possible to understand Wireless !

This need not deter the reader, however. Nobody ever fully understands any book. Not even its author. If the reader succeeds in understanding any part of the present book, he may congratulate himself.

All stories worth reading begin with " Once upon a time." In order to fool the reader into reading this book we will commence in the correct style.

Once upon a time, about a hundred years ago, a Wise Mathematician named Clerk-Maxwell

was so clever that he had worked out all the sums he or any one else had thought of. He then set about thinking of some more sums to do.

After a great deal of thought he decided to invent Wireless. He went to a Well-Known Stores and bought a stock of paper and pencils, and set to work. He found, however, that he could not get the right answers to his sums at first. So he had to go back to the Stores and buy an indiarubber.

At last he succeeded in getting the right answers and invented Wireless, but as he wasn't a real Wireless Fan he did not try any experiments.

He next wrote to the papers about it, telling people what he had done. Nobody ever took much notice of mere mathematicians, however, and, moreover, as he hadn't a Publicity Agent, scarcely anybody took any interest in what he said.

One or two people, however, thought it would be good fun to be Wireless Fans, so they scrounged in their Junk Boxes and lashed up some Apparatus.

One of these Fans was a Professor of Music named Hughes, who lived in a house close to the present Broadcasting House in Portland Place. He carried out some DX [1] experiments between

EARLY WIRELESS EXPERIMENTS IN PORTLAND PLACE.

his house and the neighbouring streets, and walked up and down Great Portland Street with a telephone to his ear and actually heard Signals over a distance of 500 yards.

[1] Term used to signify Wireless Long Distance. Pronounced *dee ex*.

Hughes's apparatus was more like Wireless than anything seen hitherto, or, possibly, since. We have been able to ascertain, without prejudice, that the total amount of wire used in his portable receiver did not exceed 17·25 inches, while the gross weight of the complete equipment was actually less than that of many a high-class modern portable set.

He gave private demonstrations to his pals, but as *he* didn't possess a Publicity Agent either, not much interest was taken in his work except in the Microphone which he invented.

Some years later, in 1888, another Wireless Fan named Hertz succeeded in getting people interested in his experiments. He showed how to produce and receive Wireless Waves, which behaved just as Clerk-Maxwell, some years earlier, had said they would behave.

Although undoubtedly the first genuine Home Constructor, Hertz was unable to buy any Wireless Components at the shop round the corner, because shops had not started to stock such things; but he extemporised an Ultra-Short-Wave Transmitter and Receiver from bits of Gear which he happened to have about.

He then began to observe Phenomena.

Now Wireless is simply full of Phenomena. Quite experienced Wireless Engineers (friends of ours) agree that there are days when it seems to be nothing else but !

This being so, it was not long before Hertz noticed things.

His Transmitter consisted of an Induction Coil (junk boxes in those days didn't contain Ford Ignition Coils) with Spark Gap and Metal Plate connected to each knob of the Spark Gap.

His Receiver [1] was merely a loop of thick wire, almost a circle, having its two extremities close together and each being provided with a Knob so as to form another Spark Gap, like that of the Transmitter.

Now there are at least two versions (our own and the other) of how the Great Phenomenon was actually discovered by Hertz. The True Version (ours) is as follows :

When he had completed and tested the Transmitter, he spent some days (and, of course,

[1] Full-sized Blue Prints, 40 in. by 30 in., of this unique circuit can be obtained (we forget where) in exchange for Cigarette Coupons.

as a True Wireless Fan, some nights) in trying to find out where the spark really went to when it disappeared.

Clerk-Maxwell had certainly said "WAVES" —and Hertz believed him.

He tried all kinds of dodges to trap the little waves in his loop of wire, or Wave-Trap—but they were very artful.

One morning (it was on a Wednesday) Hertz, having rushed his eggs and bacon and hastened to his Wireless Den, discovered that an over-zealous maid-of-all-work by the name of Millie Watt, had, in process of "cleaning up," employed some early form of Metal Polish upon the knobs of the detector loop or Wave-Trap which had been left suspended from a convenient candelabrum.

Her mistaken efforts (and what modern Wireless Fan has not experienced similar misplaced zeal?) had burnished the spherical knobs until they reflected the morning sunlight (it was a *fine* day) in twin points of light.

Hertz was quite cross about it—at first—but, noting the reflected light, and, of course, being always on the look-out for a Phenomenon, he

quickly resumed his Experiments, to find that the sparks of the Transmitter were actually reflected in the Spark Gap of his detector loop (or Wave-Trap).

He placed his finger in the receiver gap and the Spark bit it—thus showing that it was genuine Electricity.

Later, Hertz did some more "reflection" experiments, using a parabolic metal plate (duly polished by the maid, Millie Watt) which he placed behind the Transmitter to reflect the waves, like a beam of light, to the Receiver. Another metal plate placed behind the latter acted as a kind of wicket-keeper and prevented the waves from going right past the Wave-Trap.

This conserved the energy of the Waves, and avoided trouble with the neighbours.

Anyhow, it just shows what can be done with a good Phenomenon + Observation.

This experience of Hertz's caused other Pioneers to regard all Phenomena with respect and to study them in case something could be learned about Wireless. Some day it will be.

As we said before, Phenomena are to be found almost anywhere in Wireless.

For example, πr^2 is a Phenomenon.[1] Many do not think so, and prefer to regard it merely as a beastly nuisance. This view, however, is to be deprecated (we deprecate it forthwith), and the earnest reader is urged to avoid this heresy and to endeavour to grasp the true inner beauty of this deeply significant Phenomenon.

Examine it separately, and in the altogether. It will bear its own reward.

That demonstration of Hertz's watered the imaginations of other people. The small band of Wireless Fans began to grow, and during the next few years other Experimenters such as Lodge, Branly, and Jackson developed improved Apparatus, particularly for "detecting" purposes, until, finally, Marconi succeeded in receiving Telegraphic Signals sent across the Atlantic (the same day) in 1901.

Thus the barriers of space were broken down with a Crash; Wireless had advented; and the Nations of the World were soon able to Answer Back to each other, while the Man-in-the-Moon looked on, and perhaps smiled.

[1] Discovered by Euclid, the originator of designs for Y.M.C.A.'s and four-wheel brakes.

CHAPTER II

A New Theory of How it Works[1]

At great trouble and expense the authors—in their laudable endeavour to benefit humanity—have worked out a Completely New Theory to explain exactly how Wireless Waves are produced and received. This Theory fits in with all known (and many unknown) facts. It can therefore be taken as being absolutely the Last Word on the subject.

According to the old, threadbare, down-at-heel Theory, an atom of any substance contains a central nucleus of positive electricity. Around this nucleus a number of particles of negative electricity called *Electrons* are revolving like planets round the sun.

Upon the domestic felicity of the nucleus and electrons has been allowed to depend, all these

[1] Readers who are not anxious to know how Wireless Works but *why* it *doesn't*, are advised to skip Chapters II. and III. after reading the first few pages, and to return to them later.

years, the operation of everything electrical—including Wireless.

Tut ! tut ! It is all so vague and indefinite.

Has any one ever seen or handled an Electron ? No !

The beauty of our New Theory lies in the fact that we assume nothing that everybody cannot visualise. One merely dons a pair of Magic Spectacles [1] which magnify everything millions of times. The rest is simple.

When viewed through these Spectacles every atom will be seen to consist of a family of Ducklings, all swimming about round their mother, just as one would expect them to do.

Some of the Ducklings are a bit more adventurous than others. They wander some distance away from Ma, but normally never go sufficiently far to get out of her sight. The families are of different size in atoms of different substances, but of exactly the same size in atoms of the same substance.

[1] These Spectacles are not yet on the market, but we are getting out full constructional details, complete with blueprints, so that Home Constructors can make them for themselves on the kitchen table. The only tools required will be a penknife and a piece of string.

Now isn't that simple?

A complete explanation of all Wireless Phenomena follows naturally from this Fundamental Idea.

All substances are divided into two classes. In the first class, the Ducklings of each atom have quite a lot of freedom. They belong to a jolly, happy-go-lucky family. In the second class, their excursions are more limited. Their families are more reserved, in fact "refained." The first are known as Conductors[1] and the second as Insulators.[2]

In a Conductor a venturesome Duckling is liable to wander so far from Mother's apron-strings that it becomes attached to a neighbouring family and finds a new Ma.

Now all the Mother Ducks know exactly the number of the family they ought to have around them, *but they can't tell one Duckling from t'other.*

When a new arrival appears on the scene it has only one hope of being allowed to stay. It must succeed in taking the place of a wander-

[1] No connection with orchestras, tramcars, or Cook's Tours.
[2] Not good "mixers."

ing member of the " new " family which, being thus displaced, must consequently join the next family circle by fair means or foul.

It will be seen later (perhaps) that wandering Ducklings usually sell their birthright for a " Spot of Voltage."

To bring about a fair exchange of Ducklings between families we require a Battery.[1]

Now " Battery " is merely a Technical Term for a device which mixes together families of different sizes and causes hopeless confusion.

Compare with Hampstead Heath on Bank Holiday. A number of lost children are collected together in one corner. A similar number of anxious Mothers endeavouring to bring their families up to full strength have been pushed into the opposite corner in the confusion.

Now leave Hampstead Heath and pay attention.

When all the lost Ducklings are allowed to return simultaneously to their fond Mammas in one mad rush this is called a *Short Circuit.*

A Short Circuit is often caused by Tender-Hearted Wireless Fans who can't bear to think

[1] Said to contain voltage—in porous spots.

of Ducklings without Mammas, and Mammas minus Ducklings.

Unfortunately, the result, like that of many good intentions, is very sad.

This is what occurs. The T.H.W.F.[1] out of pity (or through sheer *joie de vivre*) connects a short piece of Conductor between the two frantic groups.

There is then such a rush to find Mammas and Offspring amongst the families composing the Conductor that the result is Roast Duckling and Roast Duck.

It seems almost incredible, but it is nevertheless true, that in a type of book called a text-book, this dramatic incident would be dismissed in three callous words—"heat is generated." (We could *never* write a book of *that* type. We are *too* sympathetic.)

The M.E.W.F.[2] is more careful. He allows the family reunions to take place gradually by making the Ducklings proceed in an orderly manner.

At Hampstead Heath the children would be

[1] Tender-Hearted Wireless Fan.
[2] More Experienced Wireless Fan.

marshalled in charge of a policeman and would march in single file—Robert leading—through the crowd to their anxious mothers.

In the case of our Electrical Ducklings, they would be made to pass through a Resistance which, unlike the jostling H.H. crowd, is composed of well-behaved families—very reserved, but *not* as " refained " as those in an Insulator.

An orderly stream of Ducklings of this nature is called a Direct Current.[1]

There is another kind of Current called Alternating Current, in which the Ducklings are moving first in one direction and then in the other. They do not get a chance to settle down with any particular family.

In this case the Battery which causes the Ducklings to become separated from their Mammas is replaced by a Device[2] which mixes up the families in a still more complicated manner. The first lot of lost Ducklings are flung to one side, and the next lot are flung to the opposite side.

[1] We refrain from cracking old chestnuts about this word, as they are out of place in a book of so serious a nature as this.

[2] Sometimes a Gadget is used.

Any arrangement which permits Ducklings to pass from one family to another to form a Current is called a Circuit.

The name is derived from that of an old gentleman named Sir Christopher Ffenomener—usually referred to as "Sir Kit"—who was a well-known breeder of Ducks many years ago.

There are other things which can form a Circuit besides a Resistance and a Battery, or other Breaker-Up-Of-Families. One of these is an Inductance. The origin of the term will be clear when we have described what an Inductance really is.

An Inductance consists of a length of Conductor, such as copper wire, which is wound in the form of a coil or spiral. When it is connected in a Circuit it completely upsets the Ducklings.

As they approach it they hesitate before undertaking such an adventurous trip. First one and then another decides to make the plunge, and off they go. When they come out at the other end they are so dizzy they can't stop. They keep on even if the B.U.O.F. has stopped working.

This effect of an Inductance is essential to Wireless and shows either (*a*) on what crazy foundations Wireless is built, or (*b*) to what dizzy heights it may attain. (Take your choice.)

The origin of the word "Inductance" will now be clear. When the Ducklings hesitate at the entrance those behind call out "In Duck-dance."

Another Component of a Circuit used for Wireless is a Condenser. A Condenser, although said to have Capacity, is really a gap in a Circuit. It is bounded on each side by a plate made of conducting material such as copper or aluminium.

When the Ducklings arrive they crowd on one plate and look across to the other plate, where there is a collection of Mammas who have been robbed of their offspring by the B.U.O.F.

If the plates are close together so that the Ducklings can easily see the Ducks on the other side, they murmur "So near and yet so far," and crowd as close to the gap as possible. This makes more room for the other Ducklings pushing behind. They "pass right along the

car," which increases the Capacity of the Condenser.

The Capacity can also be increased by filling the gap with a Substance composed of a large number of "refained" families. (An Insulator? *Quate* correct!) Ducklings endeavour to force their way into these families, and more lost Ducklings crowd in behind.

But it's no use. There is no room in High Society for homeless Ducklings. The only thing for them to do is to go back the way they came, as soon as the crowd behind will let them.

Their opportunity arrives when the Breaker-Up-Of-Families begins to send Ducklings in the opposite direction.

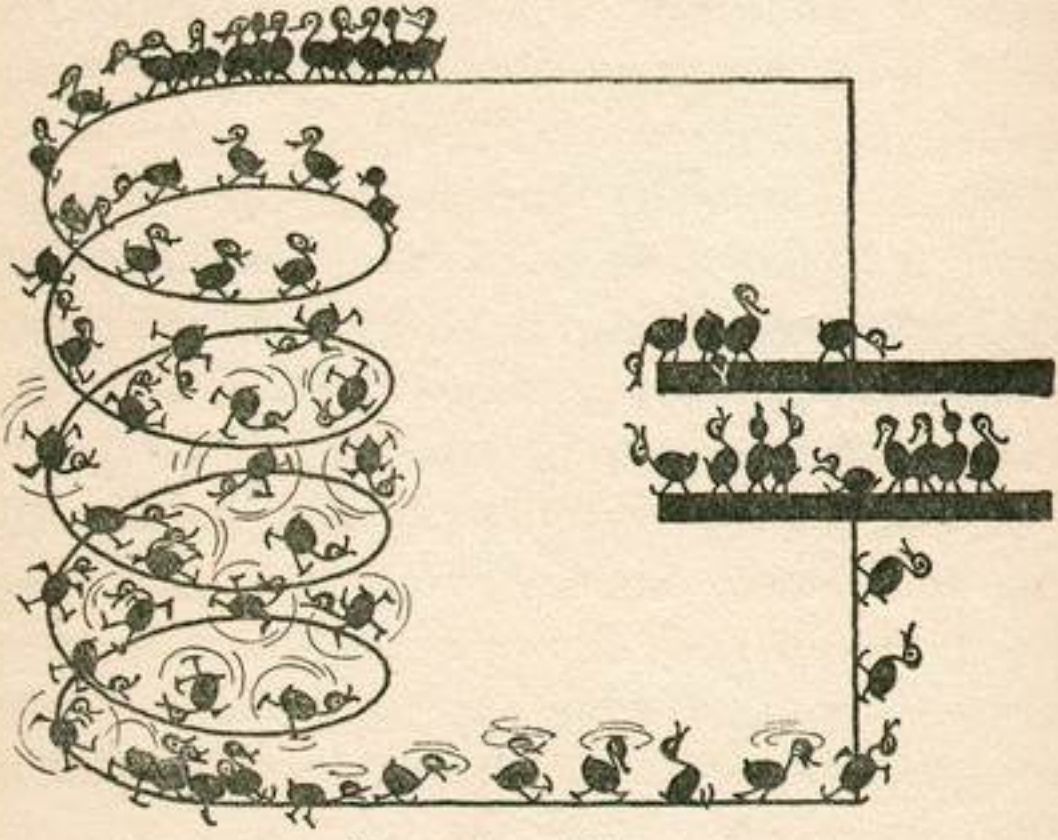
. . . . . .

We now come to a Circuit which contains both a Condenser and an Inductance. This is often called an Oscillatory [1] Circuit.

Suppose the Ducklings have been set in motion by a B.U.O.F., and that their path lies through the Inductance. After they get through that they come to the Condenser. While a crowd of

[1] Origin of this term is doubtful. Not to be confused with Osculatory, which is quite different.

Ducklings is at one end of the Inductance awaiting its turn to loop-the-loop, others are leaving the other end in a dizzy state and crowding together at the gap formed by the Condenser.



AN "OSCILLATORY" CIRCUIT.

If there is not much room at the Condenser it may become full before all the Ducklings waiting at the beginning of the Inductance get their turn at looping-the-loop. The B.U.O.F. then starts to operate in the reverse direction,

and back they have to go without having had their money's worth by completing their trip round the Circuit.

This state of affairs would hurt the feelings of Tender-Hearted Wireless Fans, so, to overcome it, what is known as Tuning was invented. The sizes of the Condenser and the Inductance are arranged so that every Duckling arriving at the Inductance gets its turn before the B.U.O.F. drags it back.

Once the Ducklings have been set in motion in this manner they will carry on after the B.U.O.F. ceases to function.

When all the Ducklings have been through the Inductance and are crowded upon one of the Plates of the Condenser, there is nothing to prevent them returning through the Inductance to their waiting Mammas on the other plate of the Condenser.

They hesitate before they take the plunge. A few adventurous ones start off round the Inductance and the others follow in ever-increasing numbers. They get so dizzy, however, in going through the Inductance that they jostle into the Happy Families they come across

and carry some of the Ducklings from these families along with them.

When they all emerge from the Inductance there are more Ducklings than the waiting Mammas want.

All the surplus Ducklings crowd on to the plate of the Condenser, and try to cross the gap to the other plate which was previously crowded with Ducklings, but which is now full of anxious Ducks which have been deprived of some of their offspring in the rush.

Immediately the original rush stops, the surplus Ducklings begin to return the way they came, and the whole business is repeated.

This journeying to and fro—Oscillation—would go on indefinitely if the wire of which the Inductance is composed had no Resistance.

In practice, however, the crowd of Ducklings rushing through the Inductance do not carry along with them an equal number of Ducklings from the Reserved Families they encounter.

When they all emerge at the other end and reunions take place with the Mammas, there are not as many surplus Ducklings as there were at the first Condenser plate.

After a few trips to and fro like this, *all* the Ducklings find homes and the Oscillations cease, unless a Breaker-Up-Of-Families is introduced to provide more lost Ducklings.

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Up to this point we have considered only what happens to the families of Ducklings. But, as every one knows, Ducklings cannot swim about in the way we have described without causing a little commotion.

What happens to the water in which they are swimming ?

Authors of books on Wireless have a great fondness for throwing stones in ponds. In their ignorance they do not know that they are liable to kill millions of Ducks and Ducklings by such behaviour.

There is no need to throw stones in ponds to explain Wireless—as we shall now proceed to show.

When a Duckling is in the water there can't be water in the space occupied by the Duckling. But when the Duckling moves to another place the space it leaves will fill up with water.

In addition, water will have to move out of the way of the Duckling. There will thus be a flow of water from where the Duckling *is* to where it *was*. If the Duckling remains still, the water does likewise, unless, of course, there are

AN EXCLUSIVE PICTURE OF CELEBRATED WIRELESS AUTHORS EXPOUNDING ELEMENTARY PRINCIPLES.

other Ducklings causing a disturbance. This is a Fundamental Principle (1).

A steady procession of Ducklings, head-to-tail, will not be accompanied by this filling-up effect. The space left by one Duckling is immediately filled by the next one, and not by water.

The water which was there before the Ducklings formed their orderly procession has been pushed to one side. There it stays until there is a change in the procession.

If the procession tails off, marks time, and then starts off gradually *in the opposite direction*, the water will flow back and will then be pushed to one side again.

There will thus be a backward and forward movement of the water near a procession of Ducklings which is constantly changing in direction. This is another Fundamental Principle (2).

If the Ducklings are crowding together first on one side of a narrow stretch of water, and then on the other, they will displace the water first in one direction and then in the other.

The movement of water in this case will be backward and forward across the narrow strip of water.

This is another Fundamental Principle (3).*

In both these cases the movement of water will be only local. It will not extend any

* The F.P.s are numbered so that the Reader does not have to keep count of them, but can concentrate upon Wireless.

appreciable distance, because the water has to return immediately to fill up the gaps. It does not have time to flow very far afield.

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Now we come to the Fundamental Principle (4) of Wireless Waves.

Suppose we have an alternating procession of Ducklings passing close to the gap in the Circuit (the so-called Condenser) where the earlier part of the procession is held up. It is possible to time things so that, after an outward movement of water has occurred from the moving procession, there is no need for this water to flow back to fill up the spaces when the procession slows down and reverses its direction.

The spaces are filled by water displaced by the crowd gathering at the gap.

An outward (or Radiating) movement is thus given to the water every time there is a change in the procession.

The water which is displaced in this manner will be swirling round in a rather complicated manner owing to the local eddies set up by the water rushing in to fill the gaps. The direction of these local eddies will change every time the

direction of the procession of Ducklings changes, although the outward movement of the swirling water will persist all the time.

The movement of this water outward (away from the seat of the disturbance) sets in motion water still farther away, and we have what is known as a Wave, travelling outward from the Circuit.

And now, without our having cast even a solitary stone, the reader is in a position to see how Wireless Waves are produced.

An Alternating Current is set up in a Circuit containing Inductance and Capacity. The values of the latter are adjusted in relation to the Frequency (the rate at which the Current changes its direction) so that the crowding of Ducklings at the Condenser occurs at the right moment.

The space between the plates of the Condenser must be fairly wide, and there must be a big procession of Ducklings close to it, to cause a big wave to flow outward.

That is why big Aerials are used at Wireless Transmitting Stations.

The Ducklings go up and down a long vertical

wire and crowd upon the horizontal wire at the top, and at the bottom (the Earth), which together form a Condenser.

An Inductance is connected in the Circuit to give correct timing of all the movements.

Of course, the Ducklings which cause all these Phenomena are a special breed.[1] They require special water to swim in.

The "Fluid" in which they swim is called the Ether.

This "Fluid" exists everywhere except where it has been pushed out of the way by a Duckling swimming in it.

A piece of any substance is merely a collection of atoms, each composed of families of Ducklings with their Mammas, all swimming round together in the Ether.

They do not swim on the surface of the Ether, but *inside* it, since it is all round them. Thus, although calling them Ducklings makes it easier for us to write this book, they really behave rather like Fish.

The Waves set up in the Ether, by the movement of Ducklings in an Oscillatory Circuit,

[1] They do not go well with Green Peas.

travel outward in all directions—up, down, and along. In fact, hither and thither—N.W. by S.E., S.W. by N.E., S.E. and Chatham, L.M.S.—and so on.

If the Waves come across any Ducklings they will be set in motion. If these Ducklings are already arranged in a suitable manner, as in an Aerial, they will be made to travel in a procession and form a current. This is another Fundamental Principle (5) used in Reception. It will be referred to again later.

Now that we have seen how Wireless Waves are formed by the movements of Ducklings (and have survived the ordeal), we will proceed, in the next chapter, to see how the Ducklings are made to move in the required manner by a Breaker-Up-Of Families called a Valve.

. . . . . .

Test Paper in connection with Chapter II

Note.—The Earnest Student is advised to gaze earnestly at himself in a mirror, and

ask himself the following questions—earnestly. (Only four questions should be attempted.)

1. Can I really visualise a Duckling which has lost its Mamma ?
2. Does Mamma Duck yearn for the return of the prodigal ? (Express the answer by suitable gesture.)
3. Do I understand Wireless Waves ?
4. Is it worth it, anyhow ?

Satisfied with his advance in the Science, the E.S. may now resume his seat and turn over —to Chapter III.—which will be even better.

CHAPTER III

The Valve as a Breaker-Up-Of-Families

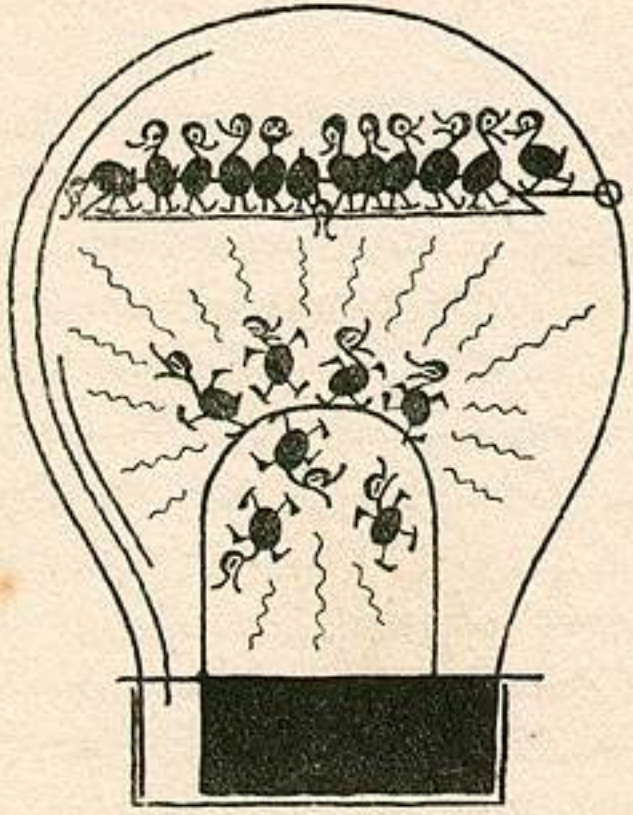
Although Wireless existed before the Wireless Valve, the Wireless Valve did not exist before Wireless. This is called an Axiom.

In the year 1904 a Wireless Fan named Fleming got tired of the sight of Crystals, and of being tickled by Cats' Whiskers, and of Co-Hearers,[1] so he decided to invent the Wireless Valve.

He begged, borrowed, stole, or otherwise acquired a small electric lamp with a carbon Filament which became incandescent when a Current from a Battery was passed through it. He then put a metal plate in the lamp at the opposite end to the Filament and connected a Battery between this Plate, or Anode, and the Filament, so that the Anode was full of Ducks which had been deprived of some of their Ducklings. Rather than be roasted alive, many of the

[1] Sometimes spelt "Coherers."

Ducklings left the Filament and managed to get across to the Ducks on the Anode. This caused a Current to flow round the circuit composed of the Battery and the Valve.



TWO-ELECTRODE THERMIONIC ROAST-DUCKLING VALVE.

What's that you say? You are quite wrong. We have *no* intention of dodging the point and leaving you in the dark.

The procession of Ducklings round the circuit and through the Valve occurs as follows:

The *first* Battery circulates Ducklings through

the Filament only. It is called the Filament Battery. The Filament is made of wire which has considerable resistance—"refained" families, you will remember—so that it becomes very hot owing to this particular stream of Duckling traffic.

The *second* Battery, called the Anode Battery, is connected so that it takes Ducklings from the Plate or Anode of the Valve, chases them through the Battery itself and, *via* the connecting wires, lands them upon the Filament. The Anode is thus left in possession of Mother Ducks anxiously looking for Ducklings.

It is no use their looking towards the abducting Battery, so they look towards the Filament —across the space in the Valve.

And what do they behold ?

A crowd of Ducklings jigging about upon the Filament like cats on red-hot bricks ; unable to sit down or even stand in comfort, and in constant fear of being roasted.

Well ! What would *any one* do ? Jump for it, of course, and that is exactly what the Ducklings do. When they arrive at the Anode, however, the Battery immediately snatches

them from their Mother Ducks and bundles them off to the Filament again.

This process continues as long as *both* Batteries remain fit to do their respective jobs.

When the second Battery was connected the other way round it sent Ducklings to the Anode and left Mother Ducks on the Filament to be roasted. The Ducklings, you see, could perch in comfort upon the *cold* Anode, so why leave it for a red-hot Filament? There was therefore no Current flow across the space in the Valve, or round the outside circuit. Simply "nothing doing."

Fleming adjusted his Battery the right way round so that there was a small Current flowing. He then connected his Valve to a Circuit connected to an Aerial.

When a Wireless Wave reached the Aerial it set the Ducklings in it swimming to and fro—or fro and to as the case may be. Some of them explored the path through the Valve.

It was easy for those moving in the same direction to go with the steady procession already passing from the Filament to the Anode. Let us call these the "to" Ducklings.

The "fro" Ducklings, however, found it difficult to go through the Valve in the opposite direction. In their attempt to do so they merely retarded slightly the procession which was already passing from Filament to Anode.

The result was that every time a Wireless Wave arrived it caused an increase in the Current flowing through the Valve when the Ducklings in the Aerial were swimming "to," but had little effect during the time they were swimming "fro."

The rest was easy. Fleming just connected a pair of Telephones in between the Valve and the Battery. Every time a big Wave arrived he heard a big noise, and every time a small Wave arrived he heard a weaker noise. (Always assuming, of course, that he was listening, and that his Batteries hadn't run down.)

In 1907 another Wireless Fan named Lee de Forest had a brain wave.

He thought it was a waste of good space in a Valve to have only a Filament and an Anode for the Ducklings to swim between. Also the poor Ducklings hadn't a sign-post to tell them which way to go when they left the Filament.

So he put a Grid[1] in the Valve, between the Filament and the Anode. Incidentally, this gave him a chance to introduce a *third* Battery—the Grid Battery.

When the Grid was made slightly "Mother Duckish" by connecting this Grid Battery (the right way round) between it and the Filament, the Ducklings escaping from the Filament saw the Mammas on the Grid looking for their offspring. So they naturally[2] made for it.

Some of them decided to join the Ducks on the Grid. Most of them, however, left the Filament with such a rush that they simply shot past to the Anode to join the larger congregation of Mammas which they could see through the spaces of the Gird as soon as they got near to it.

When the Grid Battery was reversed, the Grid was occupied by Ducklings, and therefore the Ducklings from the Filament knew it was not much use going that way. Only a few of the more

[1] Similar to the well-known kipper-cooking apparatus—only smaller, of course.

[2] Remember the urge of the red-hot Filament.

venturesome decided to risk it, and reached the Anode—more or less exhausted.

From this it will be seen (we hope) that a lot depends upon whether the Grid is occupied by Ducks or by Ducklings.

In either case, the addition or subtraction [1] of only a few, exercises a control of the Duckling traffic through the Grid.

Thus any small changes in the electrical state of the Grid causes *bigger* changes in the Anode Current.

This is a Fundamental Principle (6).

Amplification [2] then became possible.

This marked a new Era. The troubles of Wireless Fans increased enormously.

It was now possible to get Louder Signals and to hear stations which previously had been too far away.

The Wireless Fan had to buy bigger log books. (More expense.) He didn't mind that so much —but he had to buy Valves which cost quite a lot of money.

He found he could use these Valves in two

[1] See any Elementary Book on "Maths."

[2] Not "Something for nothing," but "much for very little."

ways.[1] He could use one to receive the Signal [2] first and then make the Signal louder by passing it through another Valve before it reached his telephones.

Alternatively, he could take the Current produced in the Aerial by the Wireless Wave and pass it through the first Valve in such a way that it was merely Amplified before it was made into an Audible [3] Signal in the next Valve.

In simple terms—he used one Valve as a Detector (sometimes termed a Rectifier) and the other as an Amplifier—or *vice versa*, *viva voce*, or nevertheless.

Things were getting thoroughly complicated by this time. Wireless by now was indeed a Tricky Business.

At this stage began the great controversy on the best method of receiving Signals by means of a Valve. It is not yet settled. It probably never will be.

[1] In "Wireless," of course, we determinedly omit details of their use as household ornaments or as rattles for young infants.

[2] Often regarded as the *raison d'être* of Wireless. Perhaps this is an exaggerated view.

[3] The Audibility certainly *is* exaggerated on many occasions.

Valves may come and Valves may go—but this controversy goes on for ever.

Much ink has been spilt and strong language used in attempts to learn and explain the differ-

TYPICAL RADIO CONTROVERSIALIST SPILLING INK.

ence between the action of a Valve when it is Rectifying and when it is Amplifying.

By means of our Great New Theory as already expounded in Chapter I., the Explanation is simple.

The ordinary reader is no doubt already quite clear in his own mind and needs no further explanation.

For the benefit of high-brow Technical Readers and those whose business it is to review books, we propose to give a more detailed explanation so that they will be able to tell us we don't know what we're talking about.

It would be a pity to make everything so easy that our critics can understand what we have written. They wouldn't have anything to write about. Our aim is to satisfy everybody.

To return to our muttons or, rather, to our Ducklings, we will first of all consider Amplification. (The intelligent reader will skip the next few pages.)

Suppose the Grid is made negative (as we say in technical parlance)—*i.e.* it contains Ducklings who have lost their Mas. This can be done by means of a Battery as already explained. These Grid Ducklings allow only a few of the Ducklings from the Filament to get past them and reach the Anode.

When a Wireless Wave sets the Ducklings in the Aerial in motion, a few more Ducklings arrive

at the Grid as a result. The procession of Ducklings between the Filament and Anode will, therefore, be still further reduced.

When the Ducklings in the Aerial are moving in the opposite direction some of the Grid Ducklings will leave the Grid to join them. More Ducklings will then be able to get past the Grid from the Filament, and the Filament-Anode procession will increase.

Thus we get the Filament-Anode procession (Anode Current) continually varying in strength. These variations are controlled by the incoming Wireless Wave and follow its variations.

When the Ducklings in the Aerial move one way the Anode Current *increases*. When the Aerial Ducklings move in the opposite direction the Anode Current *decreases*.

Our varying processions in the Anode Circuit are just the same as if we had our original steady flow of Ducklings—before the Signal arrived—together with a new procession which proceeds to and fro along with the main steady one.

The total effect, however, is that the combined procession is always moving from Filament to

Anode. It can never flow from Anode to Filament, because all the Ducklings are expelled by the hot Filament to form the procession.

This to-and-fro procession in the Anode Circuit will be larger than the to-and-fro procession in the Aerial Circuit, because of the controlling effect of the Ducklings from the Aerial arriving on the Grid.

It will also vary in the same way as the Aerial Current varies. If it varies *exactly* as the Aerial Current varies, all we have done is to produce an *amplified* version of what is occurring in the Aerial Circuit.

If we connect a pair of Telephones in the Anode Circuit so that the Current passes through them, the Telephones do not respond. The changes in the procession are too rapid.

Before the Telephone Diaphragm has had time to move one way the Current reverses and is trying to move it the opposite way. The result is that it stays still.

This is another Fundamental Principle.* We make no claim for this particular one being exclusive to Wireless.

* Not numbered. Consider this a *buckshee* one.

Now we come to Rectification—the Waterloo of nearly all writers on Wireless.

Are we afraid? No! With our Great New Theory behind us we fear nothing. Not even the Critics.

Retaining our pipes in our mouths, and casting on one side our slide-rule and horoscope, we now proceed to explain the so-called difficult subject of Rectification in fewer words than it has been explained in before. Ever.

Let us return to our lost Ducklings on the Grid.

When a Wireless Wave arrives, these Ducklings will alternately be joined by further Ducklings and deserted by a few of their number.

If there were so many to start with that very few Ducklings from the Filament were able to get past them to the Anode, the arrival of quite a large number of "Aerial" Ducklings on the Grid would have very little effect on the Anode Current.

When, however, the Aerial procession reverses its direction, and a similar number of Ducklings leave the Grid, there will be a con-

siderable increase in the Filament-to-Anode procession of Ducklings.

The result will be that, instead of this increased flow of Ducklings being counterbalanced by the decreased flow when the Aerial procession was reversed—as in Amplification—there will be a net increase in the total number of Duckings flowing to the Anode.

This net increase will vary every time the strength of the incoming Wave varies.

Any changes in the Wave produced at the transmitting station will thus produce corresponding changes in this net increase of Anode Current at the receiver.

Provided these changes occur sufficiently slowly, they will actuate a pair of Telephones and will produce Audible Signals. If the changes correspond to "sound vibrations," similar sounds will be heard in the Telephones.

Thus the sound-frequency changes in the strength of the Wireless Wave are made audible, although the Wireless Waves themselves occur so rapidly that they will not operate the Telephones. And that is why Rectification is necessary.

Now isn't that perfectly simple ?

As we have indicated, there are various ways of making a Valve rectify. In fact, there are other methods of rectification that do not require a Valve. But the Fundamental Principle of Rectification (7) is the same in all cases. It is quite simple.

The procession of Ducklings produced by a Wireless Wave, or a corresponding Oscillatory Current, must be greater in one direction than in the other. Any device, gadget, or whatnot which does this is a Rectifier.

The method of using a Valve as a Rectifier—which we have just made so clear—is known as Anode Rectification.

Grid Rectification is more common, but it follows the same F.P. Rectification is made to occur in the Grid Circuit, and the Anode Circuit is used to amplify the low-frequency Signals thus produced.

The Grid is first made *slightly positive* (instead of negative), so that it contains a few Mother Ducks looking for their lost offspring.

There is, therefore, a flow of Ducklings from the Filament to the Grid as well as to the

Anode, where, naturally, there are lots of Ducks looking for Ducklings.

When Ducklings arrive on the Grid from the Aerial in sufficient numbers to complete the families there, the flow from the Filament to the Grid will stop altogether. Any further arrivals of Ducklings from the Aerial will have no effect.

When the Aerial procession reverses, however, Ducklings leave the Grid and are followed by Ducklings which arrive on the Grid from the Filament.

The net result is that more Ducklings flow from the Filament to the Grid (within the Valve) than flow in the opposite direction.

The action is just the same as that which occurs in the Anode Circuit in the case of Anode Rectification. Some Ducklings will accumulate on the Grid, and the number which accumulate will depend on the changes in strength of the incoming Wave.

These accumulations on the Grid will cause corresponding changes in the Anode Current—and Amplification will take place.

That is the whole story of Rectification, and

if you do not know as much about the subject now as we do, you are worse than we thought you were.

. . . . . .

As we have survived the Battle of Waterloo with our pipes still alight, we feel sufficiently energetic to describe Reaction.

Like many things in Wireless, Reaction is known by other names. For example—Retro-action, Feedback, and Back-Coupling. Also some we daren't print, and others we haven't yet learned.

Reaction is, apparently, a way of getting something for nothing, but there is a Snag.[1]

In Reaction the Ducklings which are set in motion in the Anode Circuit by the Movement of Ducklings in the Grid Circuit are allowed to swim near the Ducklings in the Grid Circuit.

There are various ways of arranging this. One is to make the Ducklings swim round an Inductance, which is placed near an Inductance connected in the Grid Circuit.

The Anode Ducklings set up such a commotion in the Ether near the Grid Ducklings

[1] Snags are the things Wireless is full of.

that many of the latter who would otherwise hang on to their Mas are dragged away from them. They are swept along with the procession of Grid Ducklings, which therefore increases in size.

This increased procession now causes bigger changes in the Anode Current and produces Louder Signals.

If the Anode procession is allowed to pass too close to the Grid procession it causes so much commotion that the poor Ducklings in the Grid Circuit can't stop. They go on rushing backwards and forwards even when there are no incoming Waves to keep them in motion.

This state of affairs is known as Oscillation.

The Oscillating Ducklings in the Grid Circuit then set in motion the Ducklings in the Aerial.

The Receiving Aerial becomes a Transmitting Aerial sending out its own Wireless Waves to interfere with the neighbours.

Such a state of affairs is *never* allowed to come about in the Best Circles.

Reaction should always be kept just below the point at which Oscillation commences, or the whole district is liable to rise in arms. We

have heard of dreadful things happening to people who oscillated.

We feel that it is our humble duty to lay great emphasis on this point for the sake of listening humanity. Before doing so we desire to put ourselves right with the world and to

DREADFUL THINGS MAY HAPPEN TO PEOPLE WHO OSCILLATE.

confess that we ourselves once oscillated. Only once.

We have now signed the pledge, however, and we strongly urge all our readers to do likewise, and to distribute to all their friends (and enemies) large notices bearing the words :

DON'T DO IT.

We have seriously considered the question of starting a Society for the Promotion of Non-Oscillation, but have been compelled, reluctantly, to abandon the idea because we saw no hope of getting anything out of it. We are too well known.

This chapter has been rather a long one. Sensible readers, however, will have skipped the parts intended for the Highbrows and Critics, and so made it into a short one.

Anyone who has skipped the whole of it will now know as much about the subject as we do; but on no account must the next chapter be missed. It is even better than the present one.

CHAPTER IV

How Wireless Waves

Readers may think that the title of this chapter is incomplete. They will think we have made a mistake. On second thoughts, however, they will realise that we (as usual) are quite right, because unless Wireless *waves* it cannot produce Waves.

So we propose to show the manner in which Wireless waves. To whom and why.

Contrary to widespread belief, it is not to the Ordinary Listener that the attentions of Wireless are directed.

The O.L. may flatter himself into believing that he is the favoured one, but when he has read this chapter he will be sadly disillusioned. He will also, of course, be wiser.

We have been at great pains to make certain for whom this waving is really intended before making the truth known in a book with such a world-wide circulation as ours.

As a result of our careful investigations we now assert that it is not the Ordinary Listener or the Man-in-the-Street who is the favoured one. It is the Man-in-the-Moon.

Yes. Emphatically, categorically, really and truly, see-that-wet-see-that-dry, with our hands on our hearts, our fingers crossed, and our noses itching, we repeat—the Man-in-the-Moon.

We fully realise that this statement will be received with scorn by "those-who-ought-to-know-better." But we believe in telling the Truth—no matter what it costs us. Up to sixpence. (Threepence each; sixpence for the two of us.)

It needs only a little thoughtful consideration to see that, in the light of this New Discovery (1), all known facts about Wireless support what we are now affirming to be true.

Please gather round—but without crowding.

We have already seen that our Wireless Ducklings swimming up and down an Aerial are actually producing Waves in the Ether in which they are swimming. (See Fundamental Principle No. 4.)

Now it is obvious to any reader who is sufficiently intelligent to have got as far as this chapter, that the Ducklings *must be waving at some one.* They wouldn't wave for nothing. Not Ducklings like ours. Most decidedly not.

Who can it be? Obviously, it must be somebody they can see. Can they see the Man-in-the-Street? Sometimes, but not unless he is quite close to the Aerial. Usually trees and houses, hills, blots on the landscape, gasometers, and similar objects get in the way.

Who else can it be? Can it be the Man-in-the-Moon?

We say. . . . Yes! With emphasis.

It might be the Sun. Ah! But—"Watchman, what of the night?" Just think how Wireless waves in the stilly night when the Sun is off duty.

It *must* be the Man-in-the-Moon.

Anyhow, we do not propose to go into *all* the reasons for this statement. Life is short, and we are anxious to get on to the next chapter, which, of course, will be even better than this one.

So we will content ourselves with describing actually what does occur without explaining *how we know.*

After all, what's the use of worrying about details like that. What's true *is* true, whatever anybody says. So there.

The Ducklings in the Transmitting Aerial, having been caused to move to and fro by means of a Valve in the manner we have already described, naturally look round for some one to wave at. Just like the trippers on the scenic railway at the seaside.

Most of them wave at the most conspicuous person, which is the Man-in-the-Moon. Inoffensive old chap.

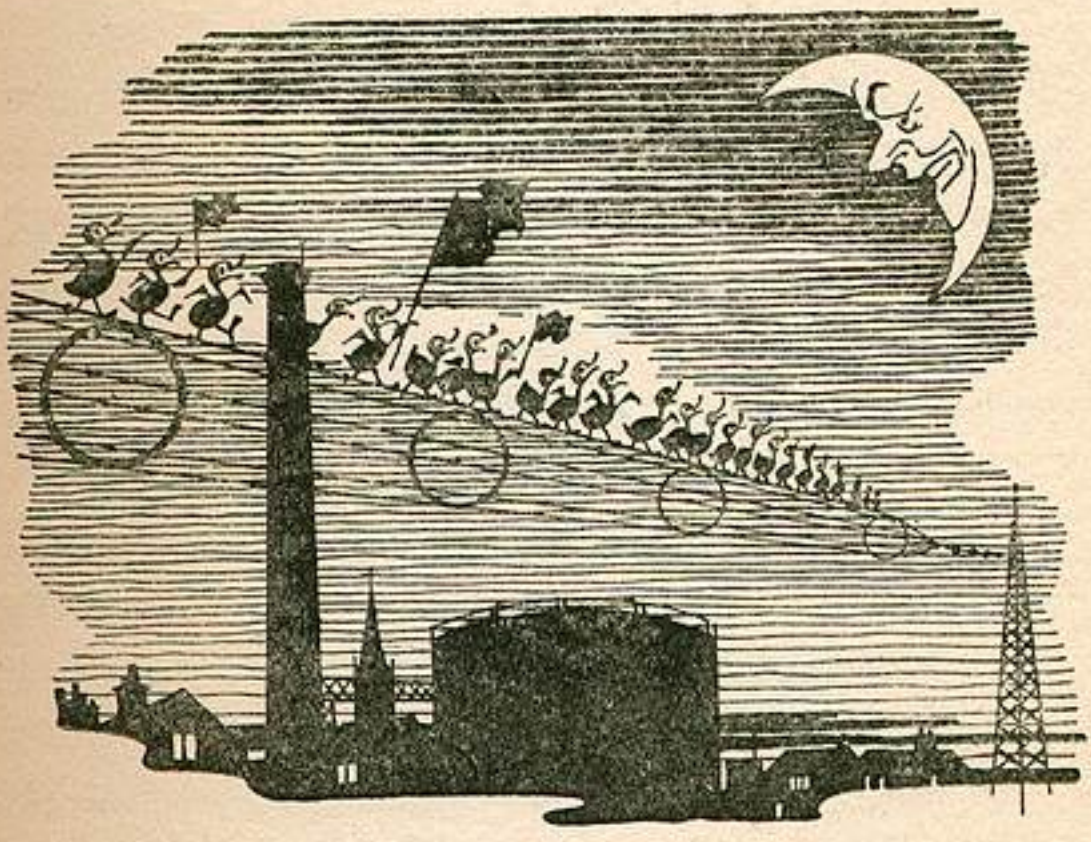
Between the Aerial Ducklings and the Moon, however, there exists a *really first-class* Phenomenon.

At a height of about sixty miles or so there are immense broods of orphaned Ducklings swimming about. (Orphaned by the action of the Sun.)

The Sun, of course, is at a very high temperature. Like the Filament of a Valve, only more so. Rather than be roasted alive, millions

of Ducklings rush away from the Sun at a terrific speed in all directions.

Some of them come hurrying towards the Earth.



THE AERIAL DUCKLINGS WAVE AT THE MAN-IN-THE-MOON.

When they reach the Upper Atmosphere they collide with some of the Happy Families swimming about there. Some of the latter are sent flying in all directions, and lots of Ducklings lose their Mas—perhaps for ever. Who knows? Even we don't.

In well-informed circles these orphaned Ducklings are called the Kennelly-Heaviside Ducklings—after the two founders of this particular orphanage.

It's no use gazing into the blue (or otherwise). You cannot see them. But they are there. We have it on the Highest Authority.

Before Wireless happened along, life must have been a dreary, unsociable affair for these stray Ducklings. Nothing to do but swim about, rather aimlessly, in circles.

Wireless has made life brighter for them.

When these orphaned Ducklings see the Ducklings in the Aerial on the Earth waving at the Man-in-the-Moon they think they are being waved at.

Of course it is just possible that some of the Waves are intended for them. Perhaps because Aerial Ducklings are notoriously sympathetic, or perhaps because they are unable to see the Man-in-the-Moon. But we won't worry about a little thing like that.

Quite naturally, the Kennelly-Heaviside Ducklings—not to be thought lacking in courtesy, *noblesse oblige*, and all that—begin to wave back.

In fact, they are so thrilled that they don't mind to whom they wave. In further fact, they get so jolly excited they even wave to one another.

But the chief thing which concerns us is that they are in a much better position to see the Ordinary Listener than are the Ducklings at the Transmitting Aerial. From their elevated position they can see quite a wide stretch of the Earth's surface.

Any Ordinary Listener they can see, therefore, gets waved at. Not as a specially favoured individual—even though he has a really posh Aerial—but just as one amongst the rest.

Now do you see how the Wireless Waves from the Transmitting Aerial reach an Ordinary Listener who is a long way off?

They reach him only because of those stray Ducklings up in the Sky. If there aren't any Ducklings to wave at him when the Aerial Ducklings are waving at the Man-in-the-Moon, he won't receive any Waves.

If there are only a few stray Ducklings to wave at him he will only receive half-hearted Waves and therefore the Signals will be weak.

When there are lots of stray Ducklings, however, they get so excited that they wave at each other as well as at people on the Earth. So the O.L. doesn't necessarily receive strong Signals even when there are *lots* of stray Ducklings in the Sky.

It is all very complicated, because so many things have to be considered: such as Barometric Acceleration, Temperature Pressure, Spots on the Sun, and Bank Holidays—to mention only a few.

The amount of *vim* which the K.-H. Ducklings put into their waving will depend on the rate at which the Aerial Ducklings are waving. We are proud to think *you* will remember that this rate [1] depends on the frequency of the Oscillations in the Transmitting Aerial.

If the frequency or rate of Oscillation in the Aerial is relatively low, the Waves will be correspondingly slow and therefore *long*.

The Aerial Ducklings give a long, strong, steady-all-together-boys Wave which the

[1] No connection with Water, Poor, or Parish Rates, which, of course, nobody ever remembers—voluntarily.

Kennelly-Heaviside Ducklings have no difficulty in returning—almost unanimously.

When the Waves of the Aerial Ducklings are very rapid indeed—and therefore shorter—the K.-H. Ducklings become very excited in trying to reciprocate.

They get in each other's way, and many of them merely wave one to another instead of to the O.L.

When there are large numbers of K.-H. Ducklings, the reciprocity is more marked at higher frequencies—shorter Waves. But they are more apt to wave at one another occasionally and to get in each other's way generally.

On the other foot, a smaller number of K.-H. Ducklings limits the excitement and interference; but, of course, there are not so many to wave at the O.L.

Quite an interesting subject, is it not ?

Anyhow, *tempus* is *fugitting*, and we think we have said enough for the intelligent reader to see that the attention paid to the O.L. by the Ducklings of the Sky may be very erratic. Hence the Signals received may be very, very erratic.

The position is also complicated by another orphanage for Ducklings still higher up. This was founded by Professor Appleton. The Ducklings in this orphanage wave when they manage to catch a glimpse of the Aerial Ducklings, past the K.-H. Ducklings.

During the daytime there will be so many stray Ducklings arriving from the Sun that the Sky is full of them; waving and dodging about.

In short—chaos. They haven't time to think of the O.L.

After dark, however, there are not so many stray Ducklings in the Sky. In the Hush of the Twilight many have stolen silently away (*à la* Arab after folding tent) and joined [1] the Happy Family of some Mother Duck.

The remaining K.-H. Ducklings therefore are better able to concentrate upon waving to the O.L.—who benefits accordingly—and the Appleton Ducklings also manage sometimes to get a glimpse and a chance to wave.

It will now be as clear as mud why Wireless Signals are stronger at night than during the day.

[1] Technically this is known as the Return of the Prodigious.

CHAPTER V

The Parts which Make the Hole

Now that we have so thoroughly dealt with the theoretical side of Wireless, we propose to deal with the more practical aspects. In the next chapter we shall give quite invaluable information on the construction of Receivers. Before doing so, however, we are going to say a few words in the present chapter about the various parts required to make a Receiver.

To a Wireless Fan the word "Parts" means those things on which he spends all his money. In other words, the things which make a hole in his pocket.[1]

It is a common belief that the cheapest way to obtain a Wireless Receiver is to buy what is

[1] Please do not confuse these with the holes made by the usual collection of terminals, B.A. screws, etc., which make literal holes. We refer to metaphorical holes, which are much worse.

called a Kit [1] of Parts, and from these to build a Receiver with one's own fair hands.

Don't you believe it. We know of lots of cheaper ways—provided you are not found out.

However, this is really a subject for the next chapter, so we will get on with *further* information about Parts.

We are great sticklers for some sort of System in everything, even though the System doesn't work.

Accordingly, we have devised a new System for dealing with the subject of Parts.

Most writers on Wireless start at the Aerial, and consider the Parts in the order in which they are connected subsequently.

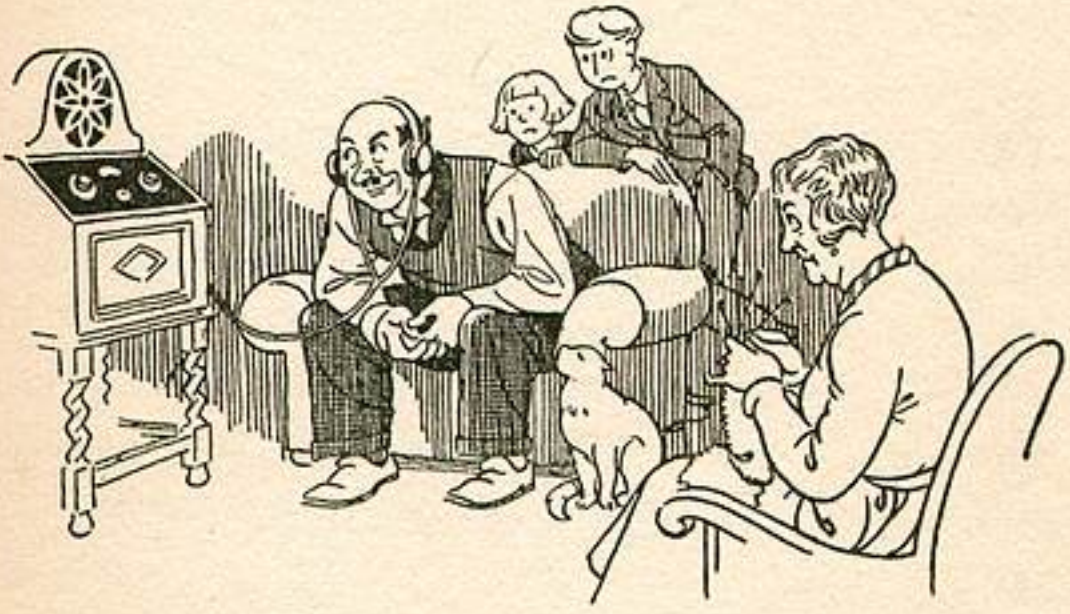
This seems to us to be such an obvious way of dealing with things that it can't possibly be right. Consequently, we have decided to start at the end where the sound appears (if any).

After all, ask yourself: "Which is the end that matters?" The answer is: "*That* is the end which matters."

[1] No relation of Sir Christopher Ffenomener, the Duck Breeder. (See p. 21.)

If there were no end for the sound to come out of, it would be no use having the other end for it to go in.

And the end, etc.—as we said before—is connected either the Loudspeaker or the Telephones or both.



ILLUSTRATING *ONE* OF THE USES OF HEADPHONES.

Telephones are used by the Head of the Household when he wants to listen to a programme which isn't fit for the rest of the family to hear.

A Loudspeaker, on the other hand, is used when the programme isn't fit for anybody to listen to. It is occasionally used, however, for

programmes which *are* fit for one or two people to hear.

There are several kinds of Loudspeaker—types such as Mothers-in-law. You know all about these from the comic papers and music-hall comedians.

The Wireless kind can be divided into three groups—Loud, Louder, and Loudest.

Alternatively, they can be divided into Bad, Worse, and the Giddy Limit. We know of other classifications, but the above are sufficient for illustration.

Many listeners prefer the type which makes the music sound "mellow." This word appears to us to be one of the most abused words we have come across in the whole of our long experience of Wireless. (Sez which ?)

Practically every Loudspeaker which makes music sound as unlike the real thing as possible is of the "mellow" type.

Presumably the majority of people do not like to hear their Loudspeakers emitting music which sounds like ordinary music.

Why, they think, go to all the trouble of having Wireless and Loudspeakers if they

merely produce music and other sounds just like what one can hear without Wireless ?

It stands to reason that a sensible person expects something different from his Loudspeaker. And he gets it.

However, we must get on with our chapter or we shall be at the end before we have really started, and that would never do.

The action of the Loudspeaker is quite simple. It usually contains a Winding or Coil through which flows a Current from the last valve in the Receiver. This Current is varying in the same way as the sounds created before the Microphone—or at least it should be.

The Ducklings forming the Loudspeaker Current set up a local disturbance, in full view of the Happy Families in an adjacent piece of iron, known as a Diaphragm, Reed, or Armature.

The Iron Ducklings, being intrigued by the "riot," change their positions to get a better view, and thereby move the iron.

The movement of the iron is transferred to a paper cone which sets the surrounding air in motion. The moving air conveys to our

listening ears sounds corresponding to the original sounds observed, so to speak, by the Microphone.

Needless to say, there are other types of Loudspeakers.

In one type—known as the *moving-coil* Loudspeaker—the iron is fixed and the coil is permitted to move instead and cause the cone to vibrate. The cone vibrates because it is glued to the coil.

This type of Loudspeaker is used by people who like the music to sound as much like the original as possible, and who like to hear a spade called a spide—not a "Thpide."

A Baffle should be employed with this type of speaker. Otherwise the delightful "boom-boom" and "pom-pom" of the jazz band will be lost, or will sound like "bang-bang" and "peep-peep," respectively.

The air waves caused by the vibrating cone set out from both sides of the cone. Those from the back travel round to the front, and as they have farther to go to reach the Listener they arrive after those from the front.

This messes things up, so a Baffle is used to

make them have still farther to go—the farther the better—so that when they do arrive at the listening ear (or ears) they are too weak to have any appreciable effect.

That is all you need to know about Loud-speakers—plus or minus what you already know—so we pass on to the real Parts inside the Box, Cabinet, Biscuit Tin, or whatever it is that contains the Receiver proper (or rampant).

At this point we have decided to make a slight modification to our System (see page 66).

All the Best Systems are so arranged that they can be modified at any time to suit changing circumstances. Ours fulfils this requirement, so we are now able to modify it without upsetting anything that has been based on it so far.

We now jump from the end of the Receiver to the beginning.

By "beginning" we mean the end to which the Aerial and Earth are connected. Let us be quite clear on that point.

At this end (beginning) of a Receiver is a Tuned Circuit. We described a Tuned Circuit in Chapter II., but as you have no doubt for-

gotten by now all that you learned from that chapter, we propose to say a little about Tuned Circuits and Tuning now.

Tuning was invented by Sir Oliver Lodge, one of the early Wireless Fans.

Like all real Wireless Fans, he believed in as many Ducklings as possible enjoying themselves, so he connected an Inductance and a Condenser to an Aerial.

When a Wireless Wave arrived at the Aerial and set some of the Ducklings in motion he adjusted the values of the Inductance and Condenser so that he got the maximum number of Ducklings looping-the-loop round the Inductance.

The Aerial Circuit was then in tune with the Incoming Wave.

Other Waves of different frequencies didn't have as much effect unless they were considerably more powerful.

The current produced by the oscillating Ducklings was thus greater than it would have been if the Aerial had not been tuned. Hence Louder Signals could be obtained from Waves to which it *was* tuned.

At the present time the Ether is so full of Waves of many different frequencies[1] that Tuning is essential in a Receiver if any particular Wave is to be received enjoyably.

One Inductance is usually employed for a large number of frequencies, and the variations in Tuning are carried out by using a Condenser whose value can be varied.

This necessitates a Knob or Dial.

The real Wireless Fan has a Grand Passion for Knobs and Dials. Mere Listeners like as few as possible. Mere Listeners, therefore, have Receivers where one Knob or Dial is made to control as many things as possible.

This is called Ganging (the "g" is hard as in concrete).

After Knobs and Dials the next most important Parts in a Receiver are the Valves. These do all the work that the Knobs and Dials don't do.

We have already dealt most exhaustively (and exhaustingly[2]) with Valves, so we will pass on to the Parts which merely connect

[1] British and Foreign, if not Home and Colonial.

[2] To everybody concerned.

the Valves together. These comprise Resistances, Condensers, Transformers, Bits of Wire, and sometimes Ditto String.

With the exception of Transformers the Reader will already know everything about these that is worth knowing.

Transformers are merely a Device for making a Current in one Circuit produce a larger or smaller Current in another Circuit or Circuits.

Simple ones for use in two Circuits consist of two coils of wire mounted close together.

An oscillatory procession of Ducklings in one coil, called the Primary, causes local disturbances in the Ether which set in motion the Ducklings in the other coil, called the Secondary.

For the Low-Frequency Currents the two coils are wound round an Iron Core which transmits these disturbances more readily from one coil to the other than does plain unvarnished Ether.

The Ducklings in the iron hang on to their Mas sufficiently tightly to avoid being torn from them. They are, however, made to form into line and "about-turn" by the Ducklings

in the Primary. In doing so they set in motion the Ducklings in the Secondary.

Any Reader who is sufficiently interested to want to know more about Parts is advised to buy[1] a Kit of them and then to study carefully the next chapter. By the time he has assembled the Parts in accordance with the instructions given in that chapter he will know as much about them as he is likely to want to know by that time.

[1] Cigarette smokers will know an alternative plan.

CHAPTER VI

Set Construction made Absolutely Easy

By the time readers have arrived at this chapter they will be able to tell whether they are destined to become Wireless Fans or otherwise.

All they have to ask themselves is: Does the sight of a Tuning Dial cause an involuntary twitching of the right hand?

This is the first symptom.

Further stages in the development of a True Fan, which may be recognised readily as they occur, are as follows:

(1) A feeling of disdain for local-station reception—such a waste of time.

(2) A conviction—becoming almost an obsession—that "the other fellow" is not getting the best out of his set because (*a*) he does not know how to handle it properly, or (*b*) perhaps the set isn't much good anyhow.

(3) An insistence upon reproduction at adequate volume. (Anything less than about 0·5 kW[1] is *not* adequate except in a very, very small room.)

(4) A critical perception of *bass* (pronounced base[2]) and *top* (pronounced as spelt) in musical programmes.

(5) A realisation that, when all things are considered, too much time is spent in mere listening.

These are the essential stages. There are others—semi-stages and demi-semi-stages—but the developing Fan will scarcely notice them.

Eventually he will adopt the universal motto of True Wireless Fans the world over :

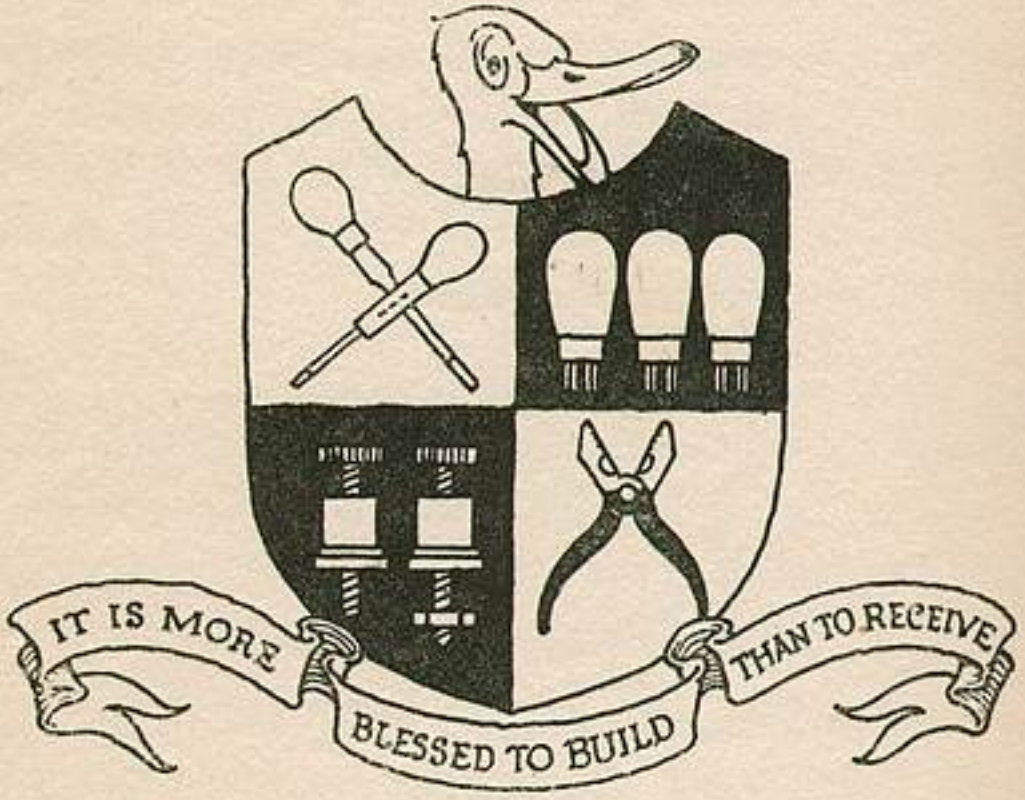
"IT IS MORE BLESSED TO BUILD THAN TO RECEIVE."

He will then meet his fellow-Fans on an equal footing, and will strive to maintain unimpaired the traditions of Fandom, learning the secret

[1] Abbreviation for kilowatt, which is equal to about 1¼ horses, 25 cats, or a brass band.

[2] A critical perception of bass (*not* pronounced base) is no criterion of a T.W.F.

signs of the Order and bearing upon his note-paper the symbol of progress: Pliers, *insulated, ouvrez, rampant*; Crossed Screwdrivers, *boxwood, ratchet,* with Valves, *metallized* and



Terminals, *brass,* duly quartered on a Shield of Aluminium *one-eighth, matt.*

One thing the T.W.F. should realise at the outset. As a Serious Investigator he is sure to meet with some slight discouragement. 'Twas ever thus with the pioneer, and no doubt 'twill ever be!

He may find, for instance, that his wife (if any) will leave him and return to her mother. On the other hand, she may merely invite Mother to come and stay with her for company.

Or it may happen that there will be slight domestic friction about selling the piano because (*a*) space is wanted for Receiving Equipment, or (*b*) cash is wanted for more No. 28 S.W.G. copper wire and solder.

It will soon become apparent to the T.W.F. that he must cultivate tact and firmness as useful side-lines. Otherwise his development in Wireless Fandom is apt to be interfered with, if not hindered.

Now we come to the real object of this (the sixth) chapter. Our T.W.F. is straining at the leash, so to speak, anxious to begin his life of adventure in Set Construction. Will we help him? We will.

We will help him completely, in three sections, entitled :

(1) Tools.
(2) Materials.
(3) And How.

As previously mentioned[1] we are staunch believers in System. We do not believe the best results are obtained by simply dumping 4 valves, 2 transformers, 1 coil, 1 H.F. choke, and a volume control into a biscuit box, slamming on the lid, and connecting to the electric supply mains. No. 240-A.C. times, No!

You have borne with us so far (thank you!) so bear with us a little longer. We are worth it.

To build Wireless Sets you must have—

Tools.

The premier position accorded to Pliers in the Badge of True Wireless Fans indicates accurately their importance in the practice of the science.

At least *six* pairs of pliers are essential. They are (1) Small Round Nose, (2) Medium Round Nose, (3) Large Round Nose, (4) Small Flat Nose, (5) Medium Flat Nose, and (6) Large Flat or "Roman" Nose.

To these may profitably[2] be added 3 Side

[1] See page 66, line 9.

[2] Proprietors of Tool Shops must live.

Cutters (1 small, 1 medium, and 1 large) and 1 pair Footprints, Alligators, or Pipe Grips.

With this range of Pliers available the T.W.F. (whom we will henceforth designate "the Set-Builder," or merely "the S.B.") will be able to choose exactly the right pair for each particular job.

For example, he (the S.B.) can use the Round-Noses for high-frequency work and the Square-Noses for low-frequency work (or *vice versa*), with occasional recourse to the Side Cutters and Pipe Grips for the detector stage.

Also, he will not be rendered *hors de combat* when, as will inevitably happen, five of the essential six pairs are lost. He will still have the *sixth* pair in his other jacket pocket. *Eureka!*

Only one or two whits less important than the Pliers are the Screwdrivers. (*One* word, please, just like that.)

The actual driving of screws is one of the least important tasks which have to be performed by this ubiquitous Device.

Their selection (number, size, and variety) therefore calls for considerable discrimination which is best exercised by the S.B. who is

acquainted with some of the peculiar demands which set-construction will make upon them.

We cannot be arbitrary about this (it is contrary to our natures) but we *do* suggest the following :

1 small Screwdriver (with yellow handle) for small screws.

1 smaller Screwdriver (black handle) for smaller screws, for opening out valve-pins, and for dislodging nuts and other oddments from condenser vanes.

1 larger, all-steel Screwdriver, for steel screws, and for poking about inside a Receiver to find a loose connection.

1 *very* large all-steel Screwdriver, for *very* large steel screws ; and for testing accumulators, high-tension batteries, and the like. May also be used for chiselling off unwanted screw-heads, terminals, etc., and for opening packing-cases containing Kits of Parts. (Altogether a *sine qua non* to the S.B.)

1 ratchet Screwdriver, for repetition screw-driving, such as screwing down empty packing-cases which have contained

Kits of Parts. Also useful for the innocent recreation of the small boy, who simply loves to hear it go "clickety-click."

. . . . . .

Probably these Pliers and Screwdrivers are about all the S.B. can carry from the Tool Shop at one go. In fact, many excellent sets have been built with these few essential Tools.

A Tool Rack is now required. This may take the form of a permanent structure of steel, brass, or aluminium erected upon a work-bench (if any) or nailed to any convenient wall.

We prefer a simpler type of furniture, and of a semi-portable nature. Our special design of Tool Rack is recommended, and was constructed as follows :

First of all, we invented a piece of wood about 4 ft. by 3 in. by $\frac{3}{4}$ in.

At intervals along the invention we bored holes—using red-hot pokers of various sizes which made holes of different diameters. To each end we nailed brass chains, each about 8 ft. in length, doubled to form 4-ft. loops. Two picture-hooks completed the labour-saving

contraption, and the holes were all filled with Pliers and Screwdrivers.

By means of this invention it is no longer necessary to carry a Receiving Set to the workshop for some slight adjustment—such as fitting a new panel and four more knobs.

Oh, dear no! Nor is it necessary to fill the dining-room mantelpiece and the settee with miscellaneous tools. Absolutely No!

One simply hangs the Coulombus-Decibel Tool Rack from the picture rail in the dining- or drawing-room, thus having everything at hand, preserving the tidy appearance of the room and, of course, the esteem of one's family. (The artistic and practical merits of this wonderful Tool Rack will be appreciated even more fully upon reference to the frontispiece of this book.)

And now to proceed with our Tools List.

We have mentioned (haven't we ?) that sets have been built with only Pliers and Screwdrivers. Some suppliers of Kits of Parts almost forbid the use of additional tools.

They apparently consider it to be taking an unfair advantage.

We are not prejudiced, however, as we have

no interest, financial or otherwise, in either Kit Shops or Tool Shops.

Therefore, in our considered opinion, there is nothing to prevent any S.B. acquiring, by fair means if necessary, any or all of the following more-or-less useful impedimenta :

2 *Hammers*—
- 1 small, for detecting microphonic or "ponging" valves.
- 1 medium, for driving staples, straightening solder, and making wiring stay put.

(Note: A *large* hammer is not necessary. The Pipe Grips can be used.)

2 *Electric Soldering Irons*—
- 1 small, for quick work.
- 1 large, for heavy work (saucepan repairs, earth connections) and for lighting cigarettes.

2 *Soldering Bits* (non-electric)—
- 1 small, right-hand, for right-hand work.
- 1 ditto, left-hand, for left-hand work.

Although called "bits" they are really whole. Excellent stand-by tools for use when the electricity bill remains unpaid.

Solder.

A start can be made with quite a small supply. There is no need to buy several cwts. We advise 0·5 lb. resin-cored linesman's solder, as used for soldering up the P.O. Telephone Exchanges. This can be used with either L.H. or R.H. Soldering Bits.

Brace and Drills.

Unlike pheasants, the brace we are speaking of is only *one*. It holds the drills at one end, the S.B. holds the other, and twirls a little wheel at the side. This causes the drill to spin round rapidly. If the drill is sharp, and the wheel is twirled the right way, a hole can be drilled in almost anything—even an oak table top. A mahogany one is easier.

A "set" of drills is required, although file ends *can* be used on occasion.

It is an Axiom in set-construction that a $\frac{3}{8}$-in. condenser spindle will not fit a $\frac{1}{4}$-in. hole. A set of about 24 drills is usually all that is *really* necessary. They

should be stored in a special Drill Rack, neatly labelled. This makes it easier to see, at a glance, how many and which are broken or missing.

Files.

1 dozen assorted will be sufficient for all general requirements—3 Round, 3 Square, 3 Flat, and 3 Miscellaneous.

Jack Knife.

1, complete with 1 large blade, 1 medium blade, 1 small blade, 1 corkscrew, and 1 thing-for-getting-stones-out-of-horses'-hoofs. Some S.B.'s wear this on a lanyard round the neck and dispense with the rest of the tools. This simplifies things considerably.

Axe.

1, Boy Scout's, for the use of (Type XM, Mk III*). A moment will come when an obstinate set calls for the attention of the axe. The moment is less likely to come if the axe is actually available.

The acquisition of these extra Tools will call for an increase in Tool Rack accommodation,

and, perhaps, the sideboard will have to be got rid of.

The addition of a further "storey" (or two if necessary) will prove an easy solution without detracting from the all-in portability of the Rack.

The Axe can be provided with its own separate length of brass chain and picture hook, and can hang gracefully from the picture rail, alongside the Tool "compact."

We now come to the important subject of

Materials.

There is an old saw [1] about "Cutting one's coat according to the cloth." This is never applied to set-building, except by very foolish S.B.'s.

Our readers might take as their second motto [2] —"Never spoil the set for a pint of shellac."

Start with the materials, all the materials, and nothing but the right materials, and a successful set is assured (by the aid of our System) from what is sometimes called the out-set.

[1] Not in the Tool Rack.

[2] Motto No. 1 is on page 77.

Before laying-in a stock of material, it is as well to arrange with the Domestic Authorities with regard to its stowage. If possible (not otherwise) a separate Store-room should be insisted upon.

Nothing is less conducive to good set-building than having to dash about collecting the materials from odd places—aluminium sheet from the garage, copper wire from the attic, shellac from the wine cellar, etc.

Of course, a lot depends upon the *joie de vivre* with which the S.B. enters the field. If he has definitely decided to go in for the Science, as such, rather than as a non-such, he can cheerfully order up all the necessary materials, such as—

Aluminium Sheet,	Copper Wire,	Brass Rod,
Brass Sheet,	Resistance Wire,	Brass Tube,
Copper Sheet,	Wiring Wire,	Brass Nuts,
Ebonite Sheet,	Wireless Wire,	Brass Bolts,
Ebonite Rod,	Aerial Wire,	Brass Screws,
Ebonite Tube,	Earth Wire,	Brass Washers.

together with a reasonable and varied supply of Valves, Knobs, Dials, Terminals, Condensers, Gridleaks, What-nots, Thingumybobs, and Sundries.

On second thoughts, however, the S.B. may decide to go in entirely for Kits of Parts, and limit his raw materials to a couple of baking-boards and a tube of seccotine.

If he does, who shall blame him ?

Certainly not us.

Why not ? Because he enables us to finish this section *pronto*, and pass along to the next.

Turning over this page brings the Reader (and us) to the final section of this thrilling chapter, in which we purpose to explain

And How

As usual, we will waste no time or space on mere verbiage, but will tackle the subject *toute suite*, explaining methodically and concisely the most practical

And How

We had intended to devote a little space (and time) to a consideration of

And Why

On second thoughts (*ours* this time) we have decided that one cannot possibly have everything in a half-crown book. We therefore ask

our reader to accept our word for the WHY, and let us get on with the HOW.

Agreed ? Right. Then here goes.

. . . . . .

Three things should be done immediately upon the arrival of each Kit of Parts. In order these are :

1. Pay the carter,[1] or sign his receipt book.
2. Unpack the gear. (For this purpose take No. 4 Screwdriver from the Tool Rack.)
3. Count the pieces. (This can never be done satisfactorily when the set is half built.)

Now put the whole lot away for three days. Buy three jig-saw puzzles—all different—and practise with them, one each evening.

This exercise quickens the perceptions and causes the S.B. to acquire a certain manipulative dexterity. It also attunes his mind to the greater problem, and affords insight into the subtleties of the Kit designer.

[1] Small Kits will arrive by post, in which case one has to get out of bed first.

Incidentally it will also teach him (*a*) to control his feelings, or (*b*) to choose suitable words to express them.

On the fourth day he can throw the jig-saw puzzles away, or give them to some child for its instruction and amusement. They have served their turn.

The Family may now be sent off to the Pictures, and the Kit of Parts can then be withdrawn from its seclusion.

Next clear the dining-room table of etceteras; draw up a chair; place the Kit Box upon the floor near the left foot; and spread out the Instruction Book before you upon the table.

Take three deep breaths and proceed to read the Book of Words.

This is a preliminary to the Identification Parade which may be conducted on one of two plans. The first is quicker, the second is more instructive.

The first plan consists in noting each consecutive item in the printed Specification and then hunting for it in the Kit Box. As each item is found it is lined up along the table. An overflow

parade can be held along the piano or sideboard (if not already sold).

Following the second plan, you simply drop your left hand into the Kit Box, haphazard, remove the first of the bits and pieces encountered, and then endeavour to identify it—either from sheer downright knowledge, or by reference to the Specification.

Removing an item from the K.B. you say—"What can this be?" A close inspection and you guess it to be an "intermediate-stage transformer supporting bracket!"

Later you are unable to find a home for it, and then discover it to be a bit of the packing-case which has dropped into the Kit Box.

Anyhow, whatever plan you choose to adopt, you must identify *all* the Parts—neither more, nor less.

By this time, no doubt, the Pictures will be "out" and the family will return home, to gaze with pride upon the results of your labours.

While that spirit prevails, pack the Parts away expeditiously, and the fact that the table top is all scratched may escape notice.

" To-morrow night," you think, " I will know just what each component is." True, but you have to find out where each of 'em *goes* in the Set-to-be. But don't worry. We will see you through.

When to-morrow evening arrives, empty the Kit Box pell-mell upon the hearth-rug, and carefully pick out the baseboard and panel, or the " chassis," as the case is.

Now we can proceed by numbers, or " judging the time," as you prefer.

(1) Set the " chassis " boldly upon the table before you. (A sheet of newspaper *may* be spread upon the table first, to catch the drops of solder. It will also safeguard the table should one (or more) of the hot Soldering Irons be inadvertently laid thereon.)

(2) Tack the Working Diagram and Specification to any convenient wall and move the table over to it.

(3) Carry the hearth-rug with all the Parts, except the chassis, over to the table.

(4) Bring in the Coulombus-Decibel Tool Rack and all Tools—except the Axe.

Hang the Rack from the picture rail on one side of the Working Diagram.

(5) Request the family to keep silence, eject the cat (and/or dog) and stop the clock.

When all is in readiness, perform the old but admirable "On the toes—STRETCH, and KNEES BEND" exercise, twelve times, slowly and breathing deeply throughout. The great moment has arrived. (Once again—*see frontispiece.*)

(6) Take each component Part, in turn, place it in its allotted position upon (or beneath) the chassis, and secure it there.

This may not prove quite as easy as it sounds. But, hang it all, it was you who practised with the jig-saw puzzles, not us.

When you have finished the "assembly" work, we advise another little spot of exercise. This time try the "Backward and Forward Bending" with that charming toe-touching effect. So productive of *savoir faire.* You may need some.

(7) Now merely connect up *all* the Parts, each to each, respectively, in strict accordance with the Working Diagram.

(8) Insert the Valves in the appropriate holders. (If Valves are not included in the Kit, go round to the little Wireless Shop and buy some. Better still, go to a Wireless Neighbour and borrow some.)

(9) Connect up the Batteries, the Loud-speaker, and the Aerial and Earth. My word, we *are* moving now.

(10) Switch on (this is important) and, *Hearken!*

(10A) Twiddle the Tuning Dial. (Try first the Right and then the Left hand.)

(10B) Twiddle any other Dials or Knobs.

(10C) Switch on again—several times.

(10D) Open the Aerial-Earth Switch. Listen!

(11) Continue listening, repeating 10A and 10B *ad lib.*

If you have no more trouble than this you deserve our Hearty Congratulations. And perhaps we deserve *yours.*

On this happy note of Mutual Congratulation we bring to a close this thrilling chapter.

CHAPTER VII

The Ills Receivers are Heir to

Every Wireless Receiver is liable to have moments of temporary aberration. In fact, it is "Wireless to err, for humans to divine."

Some Receivers are, of course, more prone to err than others. The object of this chapter is to teach all who are so fortunate as to read this book, how to become good Wireless Diviners.

Really Expert Diviners (abb. E.D.) are born, not made. Some Readers will already have the gift, lying dormant.[1] They do not know they have it. Nobody has told them—until now.

Many S.B.'s (Set Builders) *never* acquire the proper divination sense. They build—patiently and frequently—and are quite satisfied when their sets work well. They infinitely prefer a set that works to one that doesn't.

On the other hand, we know *personally* several S.B.'s who have made such progress

[1] Or, possibly, standing up.

in the higher science of Fault Divining that they have abandoned Set-Building altogether, and become E.D.'s.

The true E.D., unlike the S.B., is scarcely interested at all in a Wireless Receiver which is working well. If it is working badly (the worse the better), or not working at all, then he is interested immediately.

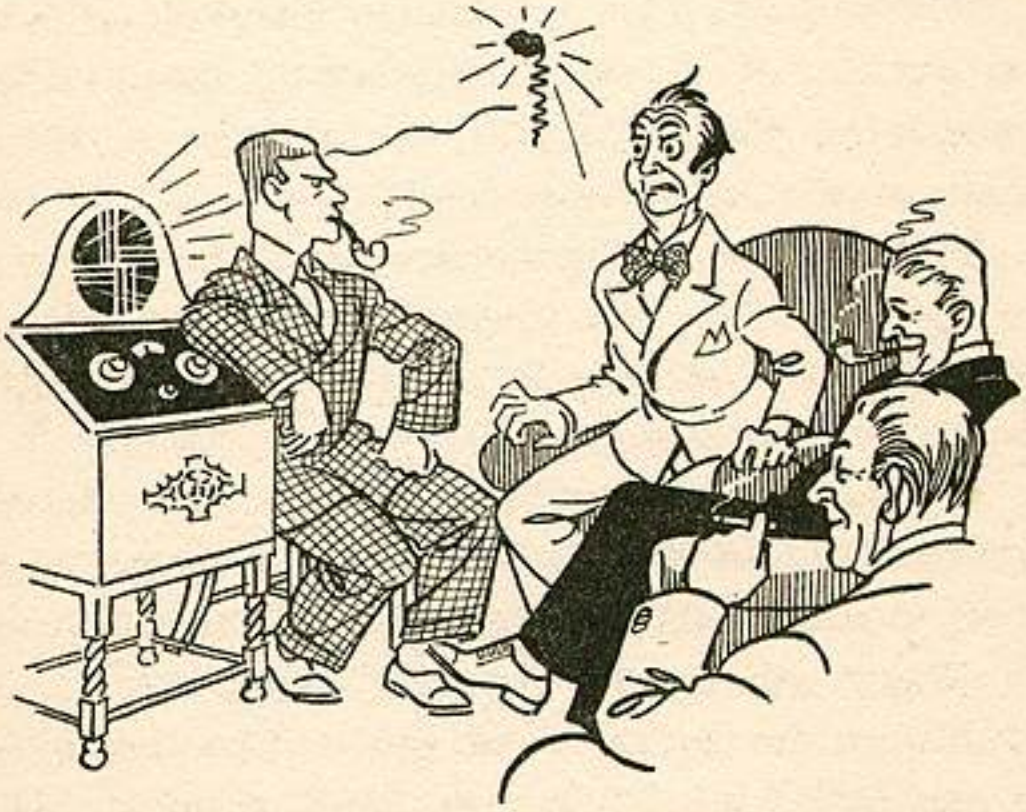
Let us show you his *modus operandi*. If you notice any of your acquaintances behaving similarly you will know them to be E.D.'s At least you can *suspect* them.

Perhaps, as an enthusiastic S.B., you have invited a few friends round to a first night performance. Your latest effort is to perform for their edification.

The guests arrive. One of them has brought a friend of his—"A very keen wireless fan, you know," he explains—and presently, they are sitting around, listening to the beautiful music (from Rome) pouring from your Loud-speaker. Possibly they are also smoking your beautiful cigarettes and sipping your beautiful beer. However, no matter.

The "keen wireless fan" is politely interested,

until, in the tricky soprano solo in *Rigoletto* (for example only, no advertisement intended) one of the high notes shows definite signs of frayed edges.



ATTITUDE OF EXPERT DIVINER OBSERVING HIGH NOTE WITH FRAYED EDGES. (GUESS WHICH IS THE E.D.)

Now watch him. His head tilts a little; his ear is cocked toward the Loudspeaker; he frowns slightly. All this denotes Perceptive Concentration.

You murmur, maybe, a slight apology, and

mention "further slight adjustment of *grid-bias*, or *decoupling*." From your friends come quiet understanding remarks or sympathetic suggestions. The E.D., however, is still Concentrating.

He appears to Concentrate throughout the remainder of the Act. You might imagine he was mentally checking over all the possible causes of that split note—from the electricity supply station to the soprano's vocal cords.

Not so. He has passed from the state of Perceptive Concentration to the state of Receptive Inspiration.

Inspiration comes to him during the applause at the end of the Act. (In strict confidence, this is a very good dodge, and he knows it.)

Rising quietly, he requests that your No. 1 Hammer be brought to him. You bring it from the Tool Rack and hand it over. He then opens the Wireless Receiver and taps the sixth valve lightly.

To every one's surprise the split part of the soprano's note is faithfully reproduced by the Loudspeaker. Smiling confidently, now, the E.D. taps the valve again. Your guests and yourself exclaim, "Ah! That's it!" . . . and

he promptly taps the valve for the last time, remarking, as the sound of the "pop" dies away . . . "The only cure, I think."

Not every S.B. who aspires to become an E.D. can acquire such skill as we have illustrated. But there are lesser degrees (and several Honourable Mentions) to which any average S.B. can attain if he studies our Method, as set out in this chapter.

That is really why we have written it. May success attend our effort. Ahem!

With our almost notorious respect for System —in one form or another—we will divide our discourse on the subject of Wireless Divining into three parts.

Part I.—which comes first—will treat the subject from the angle of a reader who knows absolutely nothing about it.[1] By the end of Part I. he will know at least twice as much.

Having read Part II. he will know something about it, and, after tripping lightly through Part III., he *should* know all about it.

And now to business.

. . . . . .

[1] In other words, "nowt."

WIRELESS FAULT DIVINING

A SHORT, SNAPPY, BUT COMPREHENSIVE INSTRUCTION COURSE FOR ALL WOULD-BE WIRELESS FAULT DIVINERS [1]

Part I.—Elementary

The first, and we *might* say, essential items are, a copy of that invaluable book, *Wireless for the Man-in-the-Moon*,[2] a threepenny notebook, and a B.B. lead pencil.

The second requirement is a supply of Faults.[3] The third and last requirement is an unlimited supply of (*a*) inquisitiveness, (*b*) determination, (*c*) pertinacity, (*d*) concentration, (*e*) inspiration, (*f*) perspiration, (*g*) faith, (*h*) hope, and (*i*) charity—coupled with some knowledge of Wireless.

The correct method of starting as a W.F.D. is to make a note (in the notebook, with the B.B. pencil) of all the faulty Wireless sets owned by friends, acquaintances, or even

[1] British and Chinese copyright very reserved.
[2] Published by George Newnes Ltd., price 2s. 6d. net.
[3] See Part II. of Course (not of course, but of Course).

neighbours. There should be *no* difficulty about this, but if you are well known in your neighbourhood you may need a sixpenny notebook.

Then get yourself invited to listen to each set, in turn. Take your notebook (and pencil) with you and refer to the former occasionally, finally shutting it with a snap and putting it away with an air of finality, saying, as you do so—"Yes, pretty good, *considering*."

Modulate heavily on the last word. Sometimes a quiet sigh is very effective, but no actual tears.

In the "profession" this is known as the approach shot, and if properly done, your host will have the Wireless set to pieces for your inspection within ten minutes.

If he takes *twenty* minutes you have certainly foozled your shot.

By the time the Student has successfully obtained an *entrée* to, say, fifteen or twenty Receivers he will appreciate the necessity for requirements (*b*) to (*f*) inclusive, and will find himself (or herself, for no doubt we have lady Students) automatically acquiring unlimited supplies of faith, hope, and charity.

So much for the Elementary. Practice assiduously and your reward will be indefinite.

Part II.—Rudimentary

A great peace will now have descended upon your neighbourhood. Fifteen (or twenty) Loud-speakers out of action makes quite a difference.

But you, our Student, must utilise the calm to prepare for the storm which will follow unless those fifteen (or twenty) set-owners receive the promised prescriptions which will cure the ills of their precious sets.

Before the set-owners become rude, let the Student become Rudimentary.

The Fundamental Idea (5) of Wireless Fault Divining is perfectly simple. We can show you in a flash. The secret is System (once again).

First, we have the established fact that any type of Wireless Set, however complicated, either (*a*) works, or (*b*) doesn't work.

If a set works, it falls into the former classification, and is therefore of no interest whatever to the W.F.D. If it doesn't work, it must be for one or two sound technical reasons, namely:

1. There is no signal[1] reaching the set, because—

(*a*) The transmitter is having lunch.

(*b*) The receiving aerial is N.G., or "earthed," or disconnected.

(*c*) The receiver is not in tune.

2. The signal reaches the set but does not emerge from the Loudspeaker, because—

(*a*) The Loudspeaker is "phut," or is not connected to the right end of the box.

(*b*) It (the signal) gets *lost* in the Wireless Set —which is not really surprising with some Sets we've seen.

All very clear and simple the way we put it, isn't it ?

The items under our first main heading (1) are quickly disposed of as follows :

(*a*) Telephone the transmitter and make an appointment, or find another transmitter.

(*b*) Erect a new aerial (*i.e.*—*advise* that this be done).

(*c*) Send for the piano-tuner.

[1] The proper technical expression for that which is, or should be, received.

Similary, if not quite identically, with our second main heading (2):

(*a*) Connect the Loudspeaker, repair it, or *advise* the purchase of a new one.

(*b*) Find where the signal gets lost, and stop the leakage with some shellac, putty, or patent "Wireless Leak Stopper."

We could write a special Technical Chapter upon Lost Signals, but we simply hate the idea. Frivolous technicalities seem to us *so* out of place in a serious book.

However, we do offer a few comments—without offence.

A search for Lost Signals should always be begun at the right end[1] of the Receiver. In this case the *end*, not the beginning.

It is not essential for the W.F.D. to be blindfold, or to go into a trance. *That* will come later.

Begin by taking the No. 1 Hammer from the Tool Rack and lightly tap the *end* valve, at the same time placing the left ear close to the

[1] If the right end comes on the left, turn the receiver round.

Loudspeaker, and turning the toes in, slightly. Listen carefully.

If a distinct "pong" is heard *from the Loudspeaker* (this is vital) murmur "O.K." and tap the next valve. Tap them all in turn.

When you come to a valve which pongeth not, murmur "Ah!" and tap a little harder.

Should there still be no "pong," murmur "GOTCHER," give it a good biff, and *advise* that a new valve be fitted.

If even the new valve will not yield a single "pong," you know that the Fault is probably not in the valve after all, but in some of the miscellaneous gadgets connected to it.

You are, at any rate, hot upon the scent. You are probably *hot* anyway.

And so the search proceeds; methodically, systematically, relentlessly, until the Fault is found—or as the best W.F.D.'s say, "located."

You are then in a position to *advise* the owner regarding the Fault, after which he can get the local Wireless dealer to put the set in order again.

Part III.—Complementary

Having dealt very fully with the Elements and Rudiments of the science of Wireless Fault Divining, we now come to the final stage.

Our reader-student, once a mere S.B. (set-builder) and now on the highway to distinction as a W.F.D., will be shown (in another flash) the true and hitherto unpublished secret of Divination.

Have you ever seen a Water Diviner at play? Neither have we, as a matter of fact, but we know he does it all with his little bent twig.

Now we claim to be the first and only Expert Diviners (E.D.'s) to apply the Water Diviner's Fundamental Principle (8) to Wireless Fault Divining.

This secret alone is worth more than the modest half-crown which you so cheerfully forked out for this book.

Our method is simple. In fact, in our quieter moments we often wonder why we never thought of it when we were boys.

We do not use a twig. Instead, we employ a peculiarly sensitive type of Inspirational-

Electrophoric-Divinoscope [1] of our own invention.

This does away with all the old-style, tap-hammer routine, and puts Fault Divining just where it should be put.

The possibilities of our method are simply boundless, being limited only by our (or your) imagination, and the number of pages allowed by our Publishers.

Held in the left hand (fingers crossed) and brought near a faulty Wireless Set the needle of the Divinoscope points with infallible accuracy to the precise spot where the signal gets lost.

If there are two spots, the needle oscillates, pointing to each in turn.

By the aid of this simple Device, therefore, any S.B. may become an E.D. of the first water. His would-be clients will have to make appointments to consult him. He will make *much* more money than he ever would by, say, writing books. Every Reader should buy one of our Divinoscopes (when available). It will not be an Outlay, but an Investment.

[1] We hope to have this simple instrument on the market in time for one of the Radio Exhibitions. It will cost about £45, 19s 11d

CHAPTER VIII

Pints and Chips[1]

This chapter is not intended for those who have become Expert Wireless Diviners as a result of reading Chapter VII. There must, however, be millions of people who have constructed Receivers in accordance with the instructions given in Chapter VI. There must also be a few odd hundreds who have still retained the Receivers they possessed before they began to read this book, and who have not acquired the art of Wireless Divining, simple as it is, as taught by us. These people no doubt will welcome a little advice on the care and maintenance of their Receivers.

As we have had considerable experience in the giving of advice, as you will have noticed already, we feel sure our Readers will derive considerable benefit from this chapter.

[1] *Errata.*—Owing to a printer's error, the title of this chapter has been given incorrectly. For *Pints* read *Hints*, and for *Chips* read *Tips*.

First of all, we will consider those little details which make all the difference to the smooth running of a Receiver.

The question of Lubrication is one of the most important of these. We give below a table of the various points which require attention in this respect.

Condenser Spindles .	Apply grease gun every 250 miles.
Accumulator . .	Check level of oil every 250 miles.
Post Office Officials .	Apply palm oil at frequent intervals.[1]
Listeners . . .	Apply suitable lubricant every half-hour.

No other attention is required to Receivers which have been constructed strictly in accordance with the instructions in Chapter VI.

After several thousand miles of running, however, it may be necessary to devote a little attention to one or two things.

If there is any doubt as to whether the accumulator requires re-charging, the following is an infallible method of making certain :

Take a length of thick copper wire and connect one end of it to one terminal of the

[1] This only applies where no Receiving Licence has been obtained.

accumulator and the other end of the wire to the other terminal.

Leave the wire in this position until the cows come home. There will then be no doubt that the accumulator requires re-charging.

If it should be found that the strength of signals is not as great as it was when the Receiver was new, many things may be responsible.

If there are no signals at all, the reason may be that the transmitter isn't working.

Assuming the batteries to be O.K., one might suspect a Valve. On the other hand, two might not. Possibly the filament of a Valve may be burnt out.

To make sure, connect the High-Tension Battery in place of the Low-Tension Battery. All doubt will then be eliminated.

After a considerable mileage it is quite likely that the Valves will have lost their emission. That is, insufficient Ducklings are being expelled from the filament.

To make sure that this is so, carefully remove the Valve from its holder. Hold it carefully in the right hand and walk, also carefully, upstairs.

Lean out of an open window below which is a stone path. Concrete is better, but stone will do.

Hold out the right arm and slowly relax the fingers. This will release the Valve, which under the Force of Gravity will begin to proceed towards the ground.

In fact, if the test is being carried out under the proper conditions, it will continue to proceed until it reaches the ground.

When it arrives there it will try to move the stone path, but if the latter has been carefully chosen it will refuse to move.

It is customary when a rapidly-moving Body (for the purpose of this test a Valve can be regarded as a Body) meets an immovable Ditto for something to happen. And it is upon this old Spanish custom that the success of the test depends.

If the stone path complies with the definition of an Immovable Body and a loud report occurs, this is a sure sign that the Valve has lost its emission.

If the only house available has no upper storey [1] the test can be carried out in a slightly

[1] *e.g.*, a bungalow.

modified form by throwing the Valve against one of the side walls.

The result will be the same in both cases.

When a Receiver which obtains its power from the electric-light mains fails to function, the reason may be that a fuse has blown.

A simple and very effective way of telling whether the supply is actually getting as far as the socket to which the set is connected is as follows :

Remove the plug from the socket and carefully insert the forefinger of the left hand into the socket so that it makes good connection with the left-hand spring plunger.

If nothing unusual occurs, carefully insert the forefinger of the right hand so that it makes good connection with the right-hand contact.

If the result of this test is that you suddenly find yourself knocked flat on your back (or even merely momentarily paralysed) it is conclusive evidence that the mains are O.K.

On the other hand, if you experience nothing of this nature, it can be safely assumed that the electricity supply is not reaching the socket. Possibly a fuse *has* blown.

In all probability the fuse box will be hidden away in the cupboard under the stairs, behind clothes-horses, brooms, golf clubs, and similar paraphernalia.

All these obstacles should be removed and placed in the hall.

When the fuse box has been unearthed it is usually possible to discover which fuse has blown because the fuse wire will be missing from the middle.

It is then necessary to fit a new piece of fuse wire.

As you won't have any, fit a piece of thick copper wire instead. A hair-pin is the orthodox thing to use, but they are so scarce in these "shingled" days.

A piece of thick copper wire may then be connected between the two contacts of the socket which feeds the Wireless Set.

Now get another member of the family to close the main switch while you watch the socket.

If there is a blinding flash and a loud report you have proved conclusively that it *was* the blown fuse which had previously prevented the supply getting to the socket.

The next thing to do is to ring up the electricity supply people, and tell them that you rather think your main fuse has blown,

LEARNING SOMETHING ABOUT FUSES.

and could they send a man along right away.

When he arrives you will learn quite a lot about fuses.

If in spite of the very useful hints and tips

we have given in this chapter you still experience trouble with your set, there are two alternatives available :

The first is to obtain the services of an experienced Wireless Diviner (preferably one who has studied carefully our System).

The second is to sell or give away your set and acquire a dog instead.

We leave the choice to you, but we would point out that a dog licence costs only 7s. 6d.

THE LAST CHAPTER

HAVING completed our almost superhuman task of instructing our fellow-men (and, possibly, others) in the science and practice of Wireless, we were about to fill our pipes and sit back in calm contemplation.

Alas! We realised that our critics (both of them) would accuse us of leaving our task incomplete unless we made reference to the latest wonder of Wireless — the Short Wave.

We, therefore, avoid any such accusations by introducing our readers forthwith (and only just in time) to—

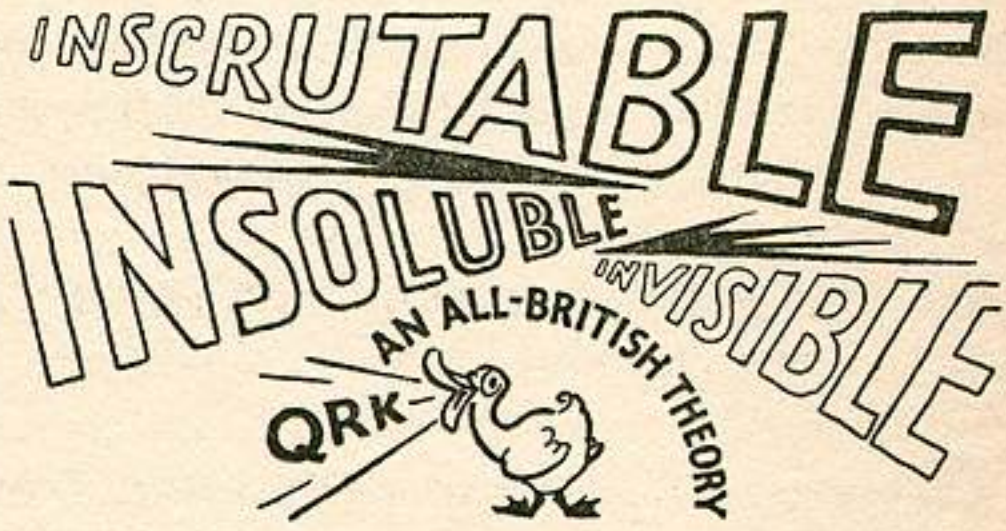
"THE SHORT WAVES"

A Stupendous Production—with All-Star Cast

THE SOUL-STIRRING, PULSATING STORY OF

THE MEGACYCLE AND THE IONOSPHERE

The Links that bind the Empire, the Tivoli, W8XX and Daventry



We now introduce a little unnecessary dialogue :

INTELLIGENT READER : "What *are* Short Waves ?"

Us : "The same as long Waves—only shorter."

I.R.: "Humph! (pronounced *Bah*). A very unsatisfactory explanation. Of what use are they?"

Us: "They inform keen listeners here in England of the merits of American tooth-paste. They invite the Eskimos to write for picture-postcards to Mr. Solianka of Moscow. They——"

I.R.: "Bah! (pronounced *Bosh*). Incredible!"

Us: "——they bring to lone settlers the latest Stock-Exchange quotations, fat-stock prices, football results, cricket scores——"

I.R.: "Ah! Utility at last. Tell me of this marvel."

. . . . . .

Once upon a time (about 1912) a small band of enthusiasts were interested in Wireless Transmission and Reception—as a hobby.[1] They were not obliged to work at Wireless. Therefore they were *very* interested indeed, and worked *very* hard to achieve success.

In those days they had only the old-fashioned "spark" type of apparatus, and were per-

[1] Hobby is wrong—it was a disease.

mitted to use only a small amount of power. Special accommodation was provided for them in the "Ether" so that they could play about to their hearts' content without interfering with anybody.

Après la guerre, experiments were resumed with improved Apparatus, including valves, and very soon Radio-Telephony Transmission between Amateurs became popular.

Much good work was done, particularly on Sunday mornings. Successful Transmissions of the magic Formulæ[1]—"Sunday, Monday, Tuesday, etc.," and "January, February, March, etc.,"[2] with frequent interjections of "OVER"—made mere on-listeners feel proud of their association with such a noble science.

At the time of which we write there were relatively few Transmitting Stations, and the tendency had been to employ Waves of greater and still greater length for long-distance communication.

[1] The expert had these formulæ memorised perfectly. The super-expert whistled them.

[2] On full-dress occasions they also shouted "1, 2, 3, 4 . . . 0,000."

It was said (and is still said) that Long Waves suffer less from *attenuation*—whatever that may be. At any rate trans-Atlantic communication was carried on, using Waves of the order of 8000 to 14,000 metres in length and with powers of umpteen kilowatts.

In fact, it seemed as if, in a little while, *one* really long Wave (stretched a bit, perhaps) would span the space between X (the Transmitter) and Y (the Receiving Station). So, for a time, the experimenters continued experimenting in peace and were allowed to use Waves of 1000, 440, and 180 to 200 metres in length.

Then Broadcasting began. Also, the number of telegraphy and commercial telephony stations began to increase very considerably.

So somebody called a Conference. To every one's surprise, something was decided.

As *one* of the results of the Conference, the experimenters lost their longer Waves (1000 and 440 metres). At a later Conference they lost the remaining Waves (180 to 200 metres), but were given others in exchange—of the order of 100 metres and below.

The idea was that, judging by experience,[1] these waves were no darned use anyhow, so the experimenters could do no harm, and they would be equally happy tapping their little brass keys or shouting "Monday, Tuesday, Wednesday," etc., on any old Wave.

So the experimenters cut down the length of their aerials, and got busy winding even *smaller* coils of even *thicker* wire upon even *smaller* jam-pots.

Presently they were all tapping away or shouting "Monday, January, 1, 2, 3, 4, etc.," as lustily as ever, but the replies to their inviting calls of "OVER" were fewer than of yore.

Hopefully they shortened aerials still further, reduced the number of turns of their tuning coils, and continued their "tappings" and "shoutings." Reports of reception became fewer still, except from very short distances—a few miles.

[1] Hertz, of course, used Short Waves, and Marconi used them in his early experiments, but found them of no use for long distances. Appleton hadn't founded his orphanage then (see page 64).

Came the Dawn

An experimenter tapped out on his key the word "Test" (subtly inviting a reply) or shouted "Over" (possibly for the hundredth time) and was amazed to hear a faint but intelligible reply. "Say Bo! You've sed a mouthful. Your sigs. air the goods, sure."

Excitement. Could it be a brother experimenter in Scotland? Hardly. And *certainly* the language was not French or Dutch.

Could it be? Yes! It was! U.S.A. Hurrah!

. . . . . .

This, and further similar occurrences, made it clear that, by some unknown means, the Short-Wave signals which could not be heard 100 miles away, came "booming in" at places 3000-odd miles distant.

How did they get there? Dear Reader(s), we will solve the mystery.

You have already seen How Wireless Waves, and have made the acquaintance of the Kennelly-Heaviside Ducklings. If not, you must have overlooked Chapter IV. Quite inadvertently, of course. That's understood.

Now meet the other brood of Ducklings—orphaned even more seriously than the K.-H. lot. These Ducklings inhabit a special orphanage known as the "F Region," founded within recent years by Professor Appleton, after whom the Ducklings are named.

The Appleton Ducklings also owe their origin and presence in the Upper Atmosphere—or, as it is popularly called, The Ionosphere [1]—to the action of the Sun.

They are more crowded together than are the K.-H. Ducklings, because lots of Ducklings arriving from the Sun prefer to stay here rather than go on to the K.-H. orphanage nearer the Earth.

Like the K.-H. Ducklings, they like to be waved at and to wave back.

But they have never seen a really long Wave.

From their greater altitude, the long waves of the Transmitting Aerial Ducklings on the

[1] The origin of this term is attributed to a well-known Wireless Fan, who on being asked, "What's on What?" replied "I on a Sphere." (This is a JOKE, but it may not be appreciated by the ordinary listener. We believe this was also the origin of the song, "Sitting on Top of the World," to which the Ducklings used to dance regularly not long ago.)

Earth are screened by the K.-H. Ducklings which are waving and dodging about at a lower altitude. (We like that word "altitude"—something lofty about it.)

So they—the Appleton Ducklings—never learn how to wave with "a long pull and a strong pull." In fact, before the Amateur fraternity got busy with Short Waves, the Appleton Ducklings had a quiet, lazy time. They have to work overtime nowadays.

We digress from our Theory, however.

The K.-H. Ducklings had become completely accustomed to the long and more-or-less leisurely Waves. We are all Creatures of Habit. They ignored altogether (or nearly altogether) the high-frequency Waves of the Short-Wave Aerial Ducklings.

The Short Waves slipped past them, almost unnoticed, and were perceived by the Appleton Ducklings, who waved back vigorously.

While commendably vigorous, however, they are by no means accurate or discriminating in their waving.

When they are waved at by Short-Wave Aerial Ducklings in England they think nothing

(or very little) of waving to Short-Wave Listeners in Nairobi and ignoring any S.W.L. in, say, Aberdeen.

Timbuctoo may be preferred to Tooting; Buenos Aires to Bournemouth; and so on.

Sometimes they suddenly think nobody is interested in their waving. Their efforts relax, and at Nairobi, Timbuctoo, or Buenos Aires, the received Signals fade out for a time.

Then, just as suddenly, vigorous waving is resumed and the S.W.L. is almost deafened.

This is just one of the little idiosyncrasies of Short Waves.

There are also others.

For example, a little spot (a mere pimple, in fact) on the face of the Sun may cause such a commotion among the Appleton Ducklings that waving either becomes simply frantic, or is completely suspended. One or the other. Never both at once.

As to the reason for this, some think one thing, and some think another. We don't think. We KNOW.

Suppose you, Dear Reader, entering your bathroom one morning to shave, discovered an

obnoxious spot (of ink, soap, or other opaque substance) upon the hitherto unblemished face of your shaving mirror. Would you become frantic, or dumb ?

Why, of course, it would all depend. The state of the old liver ; how you spent the previous evening ; what bills the postman had brought—and so on. May it not be the same with the Appleton Ducklings on Sun-Spot Days ?

Anyhow, here is room for conjecture.

ROOM FOR CONJECTURE

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THE END